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CROSS-SECTIONS OF LARGE-ANGLE HADRON PRODUCTION IN PROTON– AND PION–NUCLEUS INTERACTIONS VI: CARBON NUCLEI AND BEAM MOMENTA FROM ± 3 GeV/c TO ± 15 GeV/c

Abstract

We report on double-differential inclusive cross-sections of the production of secondary protons, charged pions, and deuterons, in the interactions with a 5% $\lambda_{\rm int}$ thick stationary carbon target, of proton and pion beams with momentum from ± 3 GeV/c to ± 15 GeV/c. Results are given for secondary particles with production angles $20^\circ < \theta < 125^\circ$. Cross-sections on carbon nuclei are compared with cross-sections on beryllium, copper, tantalum and lead nuclei.

The HARP–CDP group

A. Bolshakova[1], I. Boyko[1], G. Chelkov[1a], D. Dedovitch[1], A. Elagin[1b], D. Emelyanov[1], M. Gostkin[1], A. Guskov[1], Z. Kroumchtein[1], Yu. Nefedov[1], K. Nikolaev[1], A. Zhemchugov[1], F. Dydak[2], J. Wotschack[2*], A. De Min[3c], V. Ammosov[4†], V. Gapienko[4], V. Koreshev[4], A. Semak[4], Yu. Sviridov[4], E. Usenko[4d], V. Zaets[4]

This publication is dedicated to the memory of our colleague V. Ammosov

[1] **Joint Institute for Nuclear Research, Dubna, Russia**
[2] **CERN, Geneva, Switzerland**
[3] **Politecnico di Milano and INFN, Sezione di Milano-Bicocca, Milan, Italy**
[4] **Institute of High Energy Physics, Protvino, Russia**

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[a] Also at the Moscow Institute of Physics and Technology, Moscow, Russia
[b] Now at Texas A&M University, College Station, USA
[c] On leave of absence at Ecole Polytechnique Fédérale, Lausanne, Switzerland
[d] Now at Institute for Nuclear Research RAS, Moscow, Russia
[†] Deceased on 11 January 2010
[*] Corresponding author; e-mail: joerg.wotschack@cern.ch

1 INTRODUCTION

The HARP experiment arose from the realization that the inclusive differential cross-sections of hadron production in the interactions of few GeV/c protons with nuclei were known only within a factor of two to three, while more precise cross-sections are in demand for several reasons. These are the optimization of the design parameters of the proton driver of a neutrino factory (see Ref. [1] and further references cited therein), but also to the understanding of the underlying physics and the modelling of Monte Carlo generators of hadron–nucleus collisions, flux predictions for conventional neutrino beams, and more precise calculations of the atmospheric neutrino flux.

The HARP experiment was designed to carry out a programme of systematic and precise (i.e., at the few per cent level) measurements of hadron production by protons and pions with momenta from 1.5 to 15 GeV/c, on a variety of target nuclei. It took data at the CERN Proton Synchrotron in 2001 and 2002.

The HARP detector combined a forward spectrometer with a large-angle spectrometer. The latter comprised a cylindrical Time Projection Chamber (TPC) around the target and an array of Resistive Plate Chambers (RPCs) that surrounded the TPC. The purpose of the TPC was track reconstruction and particle identification by $\mathrm{d}E/\mathrm{d}x$. The purpose of the RPCs was to complement the particle identification by time of flight.

This is the sixth of a series of cross-section papers with results from the HARP experiment. In the first paper [2] we described the detector characteristics and our analysis algorithms, on the example of $+8.9$ GeV/c and -8.0 GeV/c beams impinging on a 5% λ_{int} Be target. The second paper [3] presented results for all beam momenta from this Be target. The third [4], fourth [5], and fifth [6] papers presented results from the interactions with 5% λ_{int} tantalum, copper, and lead targets. In this paper, we report on the large-angle production (polar angle θ in the range $20^\circ < \theta < 125^\circ$) of secondary protons and charged pions, and of deuterons, in the interactions with a 5% λ_{int} carbon target of protons and pions with beam momenta of ± 3.0, ± 5.0, ± 8.0, ± 12.0, and ± 15.0 GeV/c.

Our work involves only the HARP large-angle spectrometer.

2 THE BEAMS AND THE HARP SPECTROMETER

The protons and pions were delivered by the T9 beam line in the East Hall of CERN's Proton Synchrotron. This beam line supports beam momenta between 1.5 and 15 GeV/c, with a momentum bite $\Delta p/p \sim 1\%$.

The beam instrumentation, the definition of the beam particle trajectory, the cuts to select 'good' beam particles, and the muon and electron contaminations of the particle beams, are the same as described, e.g., in Ref. [2].

The target was a disc made of high-purity (99.99%) carbon, with a radius of 15.13 mm and a thickness of 18.95 mm (5% λ_{int}). The target weight had been measured to be 25.656 g, leading to an average target density of 1.88 g/cm^3, 17% lower than the data book value of 2.27 g/cm^3. We used the measured value of 1.88 g/cm^3 for the cross-section normalization.

The finite thickness of the target leads to a small attenuation of the number of incident beam particles. The attenuation factor is $f_{\mathrm{att}} = 0.975$.

Our calibration work on the HARP TPC and RPCs is described in detail in Refs. [7] and [8], and in references cited therein.

The momentum resolution $\sigma(1/p_{\mathrm{T}})$ of the HARP–TPC is typically 0.2 (GeV/c)$^{-1}$ and worsens towards small relative particle velocity β and small polar angle θ. The absolute momentum

scale is determined to be correct to better than 2%, both for positively and negatively charged particles.

The polar angle θ is measured in the TPC with a resolution of $\sim$9 mrad, for a representative angle of $\theta = 60^\circ$. To this a multiple scattering error has to be added which is on the average $\sim$7 mrad for a proton with $p_{\mathrm{T}} = 500$ MeV/c in the TPC gas and $\theta = 60^\circ$, and $\sim$4 mrad for a pion with the same characteristics. The polar-angle scale is correct to better than 2 mrad.

The TPC measures $\mathrm{d}E/\mathrm{d}x$ with a resolution of 16% for a track length of 300 mm.

The intrinsic efficiency of the RPCs that surround the TPC is better than 98%.

The intrinsic time resolution of the RPCs is 127 ps and the system time-of-flight resolution (that includes the jitter of the arrival time of the beam particle at the target) is 175 ps.

To separate measured particles into species, we assign on the basis of $\mathrm{d}E/\mathrm{d}x$ and β to each particle a probability of being a proton, a pion (muon), or an electron, respectively. The probabilities add up to unity, so that the number of particles is conserved. These probabilities are used for weighting when entering tracks into plots or tables.

A general discussion of the systematic errors can be found, e.g., in Ref. [2]. For the data from the -3, -5 and $+5$ GeV/c beams, the systematic error arising from the parametrization of proton and pion abundances in the respective Monte Carlo simulations was doubled. All systematic errors are propagated into the momentum spectra of secondaries and then added in quadrature. They add up to a systematic uncertainty of our inclusive cross-sections at the few-per-cent level, mainly from errors in the normalization, in the momentum measurement, in particle identification, and in the corrections applied to the data.

3 Monte Carlo simulation

We used the Geant4 tool kit [9] for the simulation of the HARP large-angle spectrometer.

Geant4's QGSP_BIC physics list provided us with reasonably realistic spectra of secondaries from incoming beam protons with momentum below 12 GeV/c. For the secondaries from beam protons at 12 and 15 GeV/c momentum, and from beam pions at all momenta, we found the standard physics lists of Geant4 unsuitable [10].

To overcome this problem, we built our own HARP_CDP physics list. It starts from Geant4's standard QBBC physics list, but the Quark–Gluon String Model is replaced by the FRITIOF string fragmentation model for kinetic energy $E > 6$ GeV; for $E < 6$ GeV, the Bertini Cascade is used for pions, and the Binary Cascade for protons; elastic and quasi-elastic scattering is disabled. Examples of the good performance of the HARP_CDP physics list are given in Ref. [10].

4 Cross-section results

In Tables A.1–A.45, collated in the Appendix of this paper, we give the double-differential inclusive cross-sections $\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$ for various combinations of incoming beam particle and secondary particle, including statistical and systematic errors. In each bin, the average momentum at the vertex and the average polar angle are also given.

The data of Tables A.1–A.45 are available in ASCII format in Ref. [11].

Some bins in the tables are empty. Cross-sections are only given if the total error is not larger than the cross-section itself. Since our track reconstruction algorithm is optimized for tracks with p_{T} above $\sim$70 MeV/c in the TPC volume, we do not give cross-sections from tracks with p_{T} below this value. Because of the absorption of slow protons in the material between the vertex and the TPC gas, and with a view to keeping the correction for absorption losses below 30%, cross-sections from protons are limited to $p > 450$ MeV/c at the interaction vertex.

Proton cross-sections are also not given if a 10% error on the proton energy loss in materials between the interaction vertex and the TPC volume leads to a momentum change larger than 2%. Pion cross-sections are not given if pions are separated from protons by less than twice the time-of-flight resolution.

The large errors and/or absence of results from the $+15$ GeV/c pion beam are caused by scarce statistics because the beam composition was dominated by protons.

We present in Figs. 1 to 7 what we consider salient features of our cross-sections.

Figure 1 shows the inclusive cross-sections of the production of protons, π^+'s, and π^-'s, from incoming protons between 3 GeV/c and 15 GeV/c momentum, as a function of their charge-signed p_{T}. The data refer to the polar-angle range $20^\circ < \theta < 30^\circ$. Figures 2 and 3 show the same for incoming π^+'s and π^-'s.

Figure 4 shows inclusive Lorentz-invariant cross-sections of the production of protons, π^+'s and π^-'s, by incoming protons between 3 GeV/c and 15 GeV/c momentum, in the rapidity range $0.6 < y < 0.8$, as a function of the charge-signed reduced transverse particle mass, $m_{\mathrm{T}} - m_0$, where m_0 is the rest mass of the respective particle. Figures 5 and 6 show the same for incoming π^+'s and π^-'s. We note the good representation of particle production by an exponential falloff with increasing reduced transverse mass.

In Fig. 7, we present the inclusive cross-sections of the production of secondary π^+'s and π^-'s, integrated over the momentum range $0.2 < p < 1.0$ GeV/c and the polar-angle range $30^\circ < \theta < 90^\circ$ in the forward hemisphere, as a function of the beam momentum.

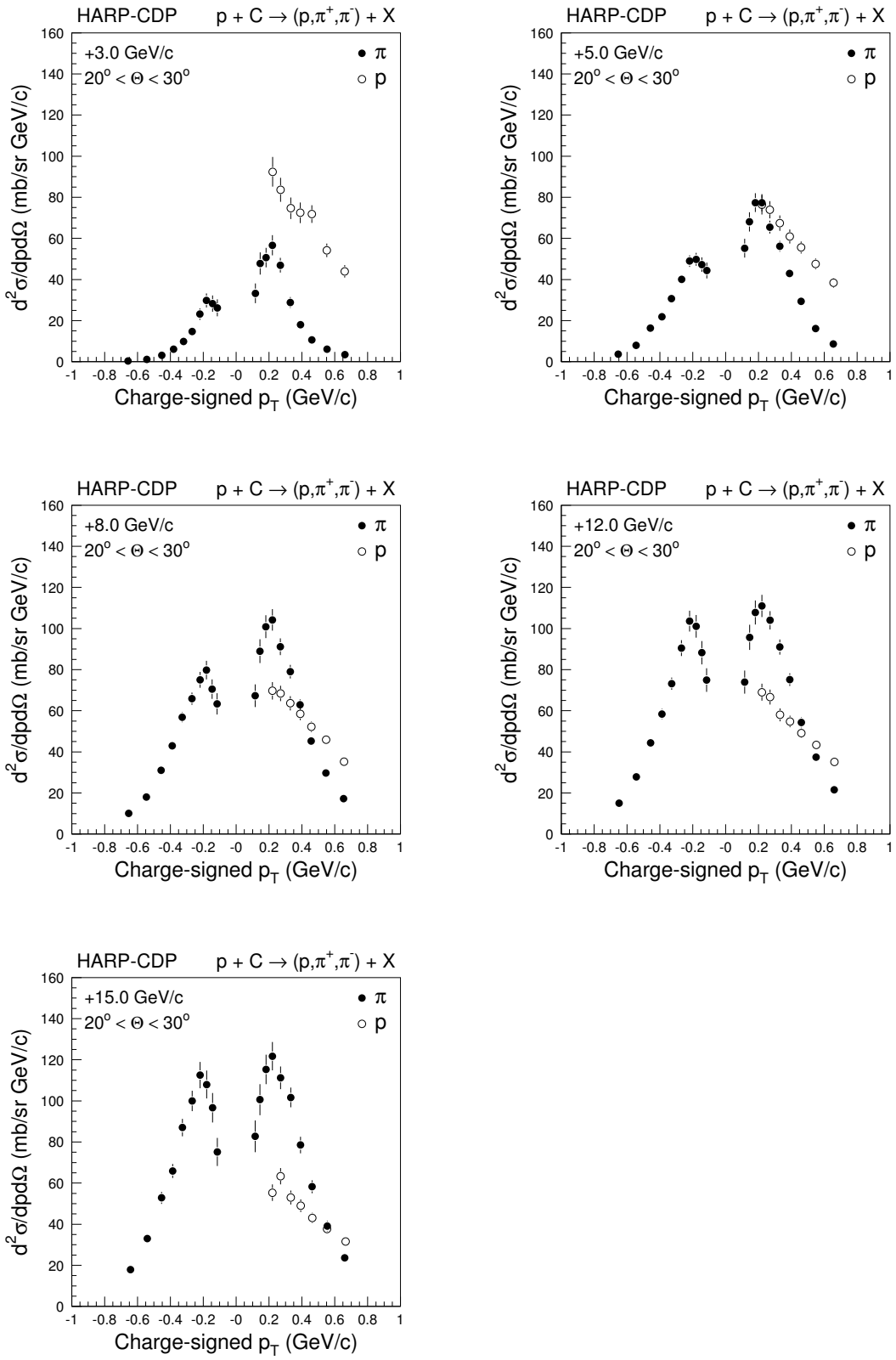

Fig. 1: Inclusive cross-sections of the production of secondary protons, π^+'s, and π^-'s, by protons on carbon nuclei, in the polar-angle range $20^\circ < \theta < 30^\circ$, for different proton beam momenta, as a function of the charge-signed p_{T} of the secondaries; the shown errors are total errors.

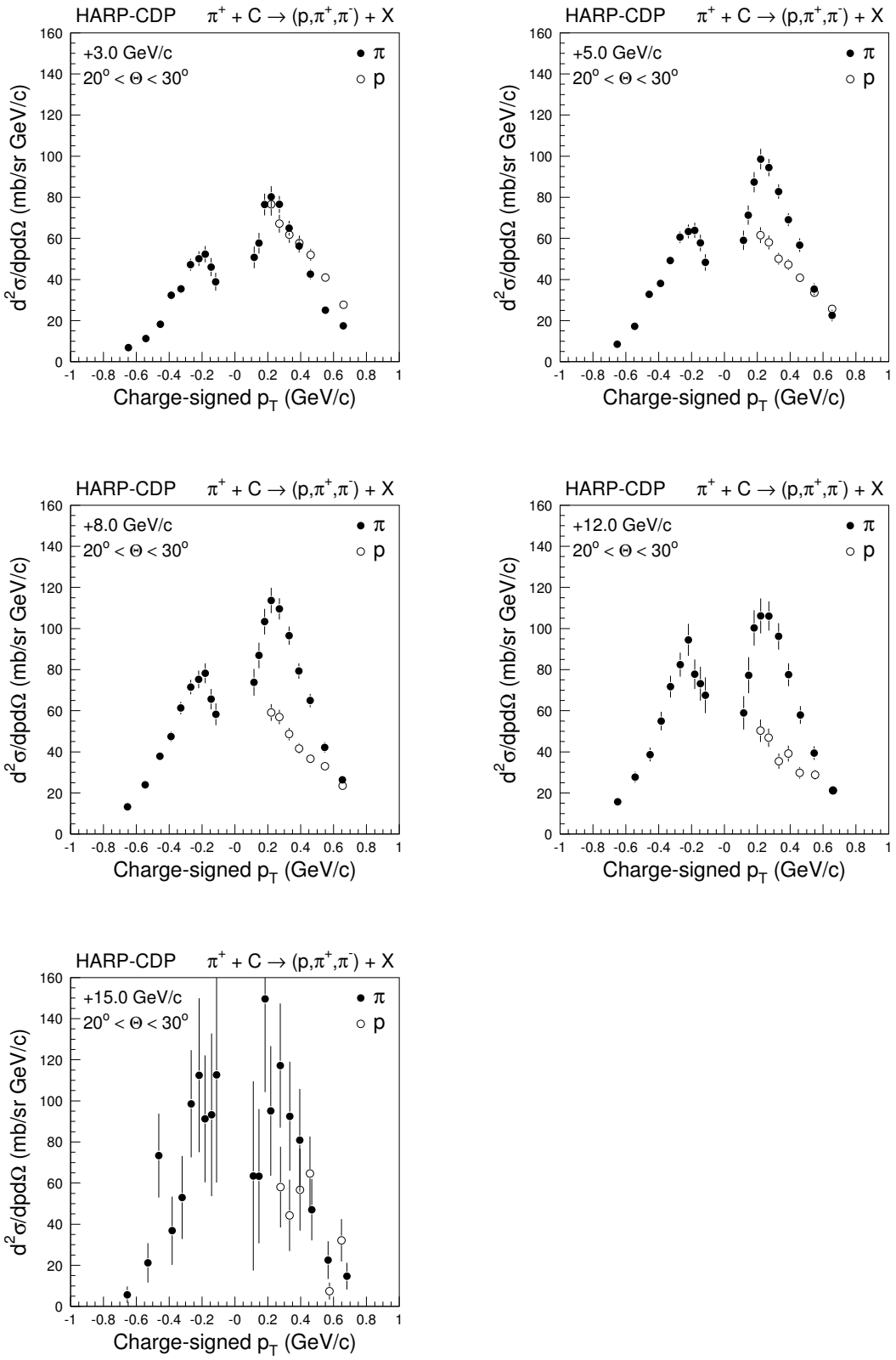

Fig. 2: Inclusive cross-sections of the production of secondary protons, π^+'s, and π^-'s, by π^+'s on carbon nuclei, in the polar-angle range $20^\circ < \theta < 30^\circ$, for different π^+ beam momenta, as a function of the charge-signed $p_{\rm T}$ of the secondaries; the shown errors are total errors.

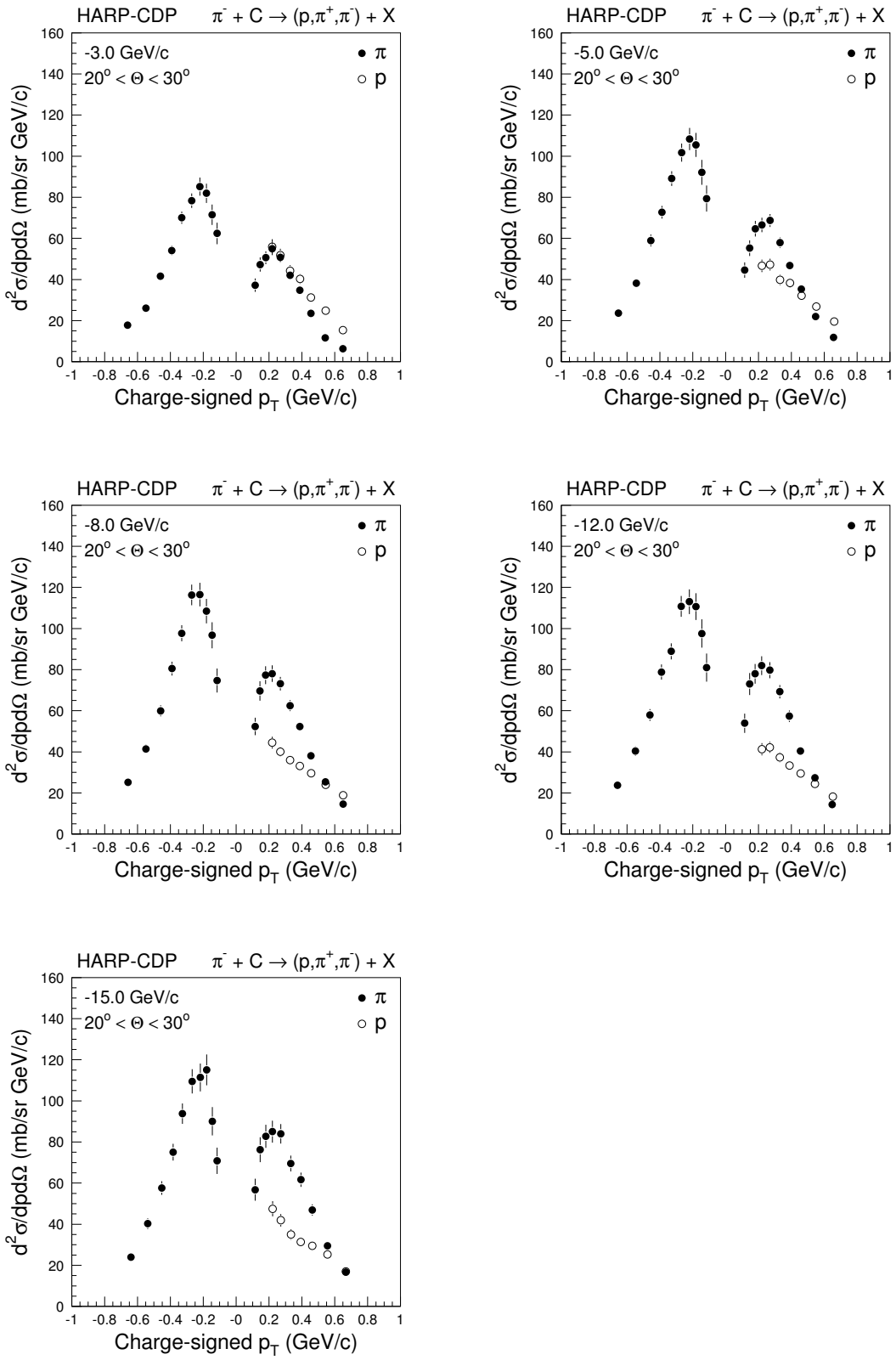

Fig. 3: Inclusive cross-sections of the production of secondary protons, π^+'s, and π^-'s, by π^-'s on carbon nuclei, in the polar-angle range $20^\circ < \theta < 30^\circ$, for different π^- beam momenta, as a function of the charge-signed p_{T} of the secondaries; the shown errors are total errors.

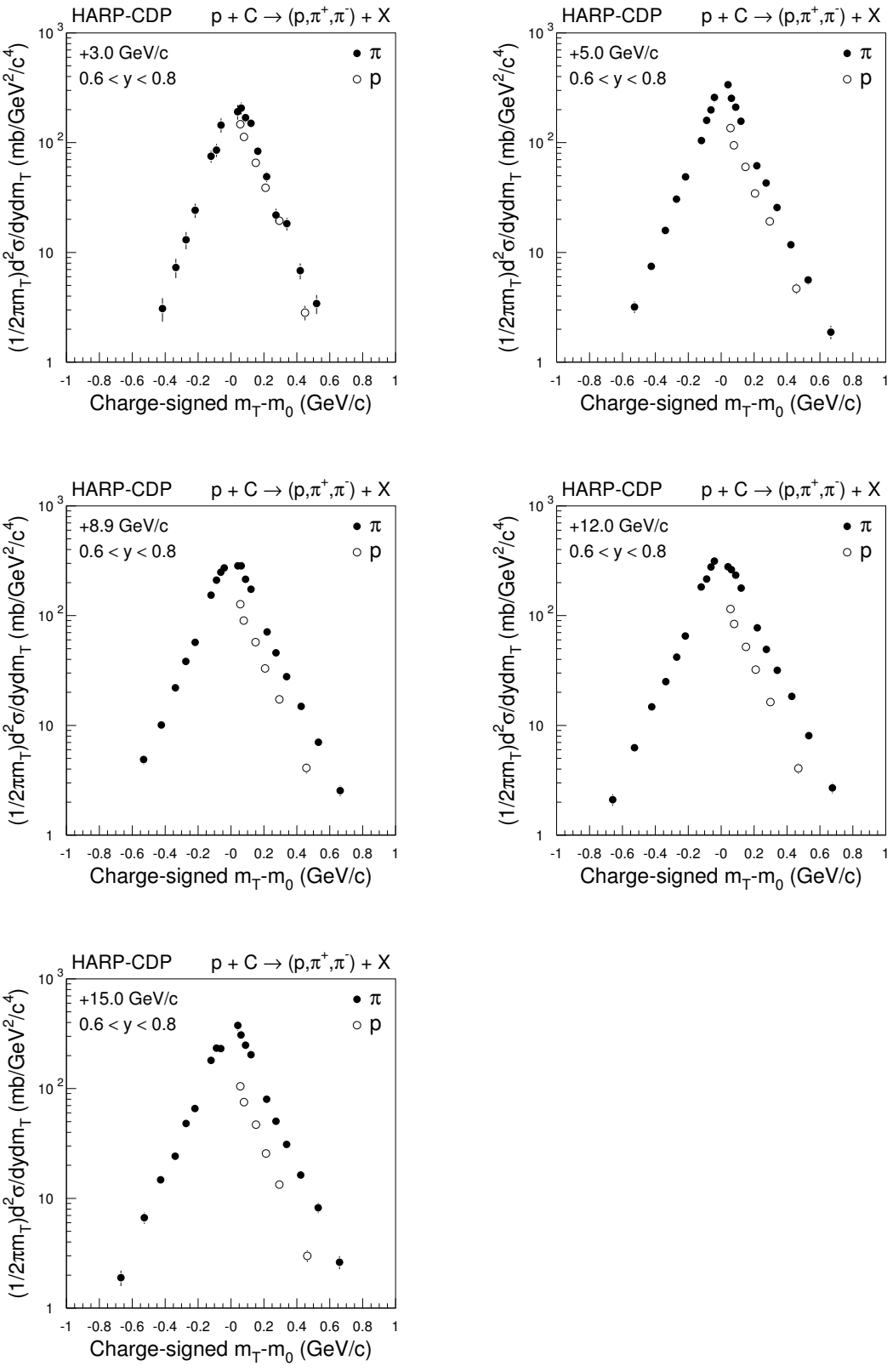

Fig. 4: Inclusive Lorentz-invariant cross-sections of the production of protons, π^+'s and π^-'s, by incoming protons between 3 GeV/c and 15 GeV/c momentum, in the rapidity range $0.6 < y < 0.8$, as a function of the charge-signed reduced transverse particle mass, $m_{\mathrm{T}} - m_0$, where m_0 is the rest mass of the respective particle; the shown errors are total errors.

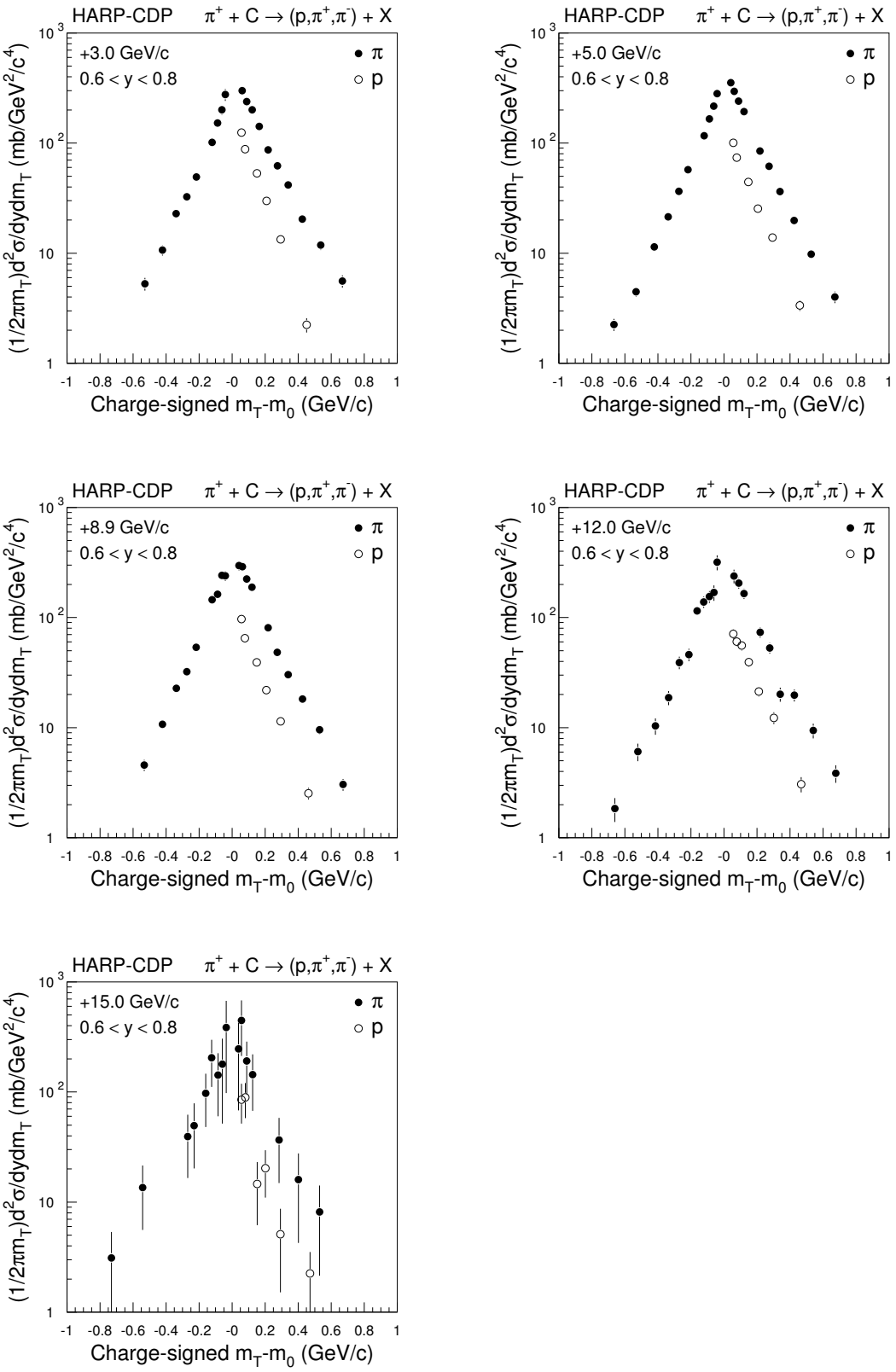

Fig. 5: Inclusive Lorentz-invariant cross-sections of the production of protons, π^+'s and π^-'s, by incoming π^+'s between 3 GeV/c and 15 GeV/c momentum, in the rapidity range $0.6 < y < 0.8$, as a function of the charge-signed reduced transverse pion mass, $m_{\rm T} - m_0$, where m_0 is the rest mass of the respective particle; the shown errors are total errors.

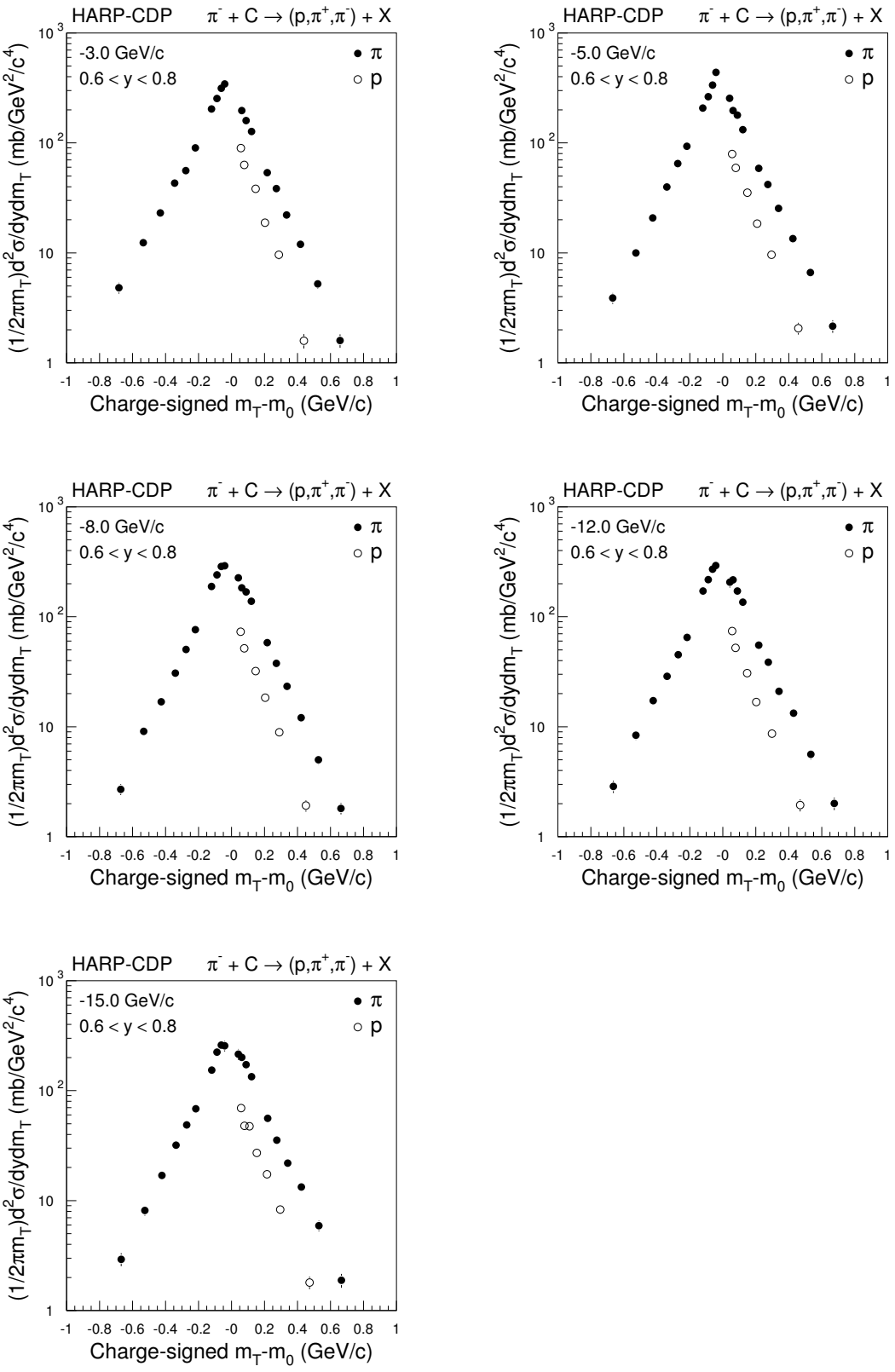

Fig. 6: Inclusive Lorentz-invariant cross-sections of the production of protons, π^+'s and π^-'s, by incoming π^-'s between 3 GeV/c and 15 GeV/c momentum, in the rapidity range $0.6 < y < 0.8$, as a function of the charge-signed reduced transverse pion mass, $m_{\mathrm{T}} - m_0$, where m_0 is the rest mass of the respective particle; the shown errors are total errors.

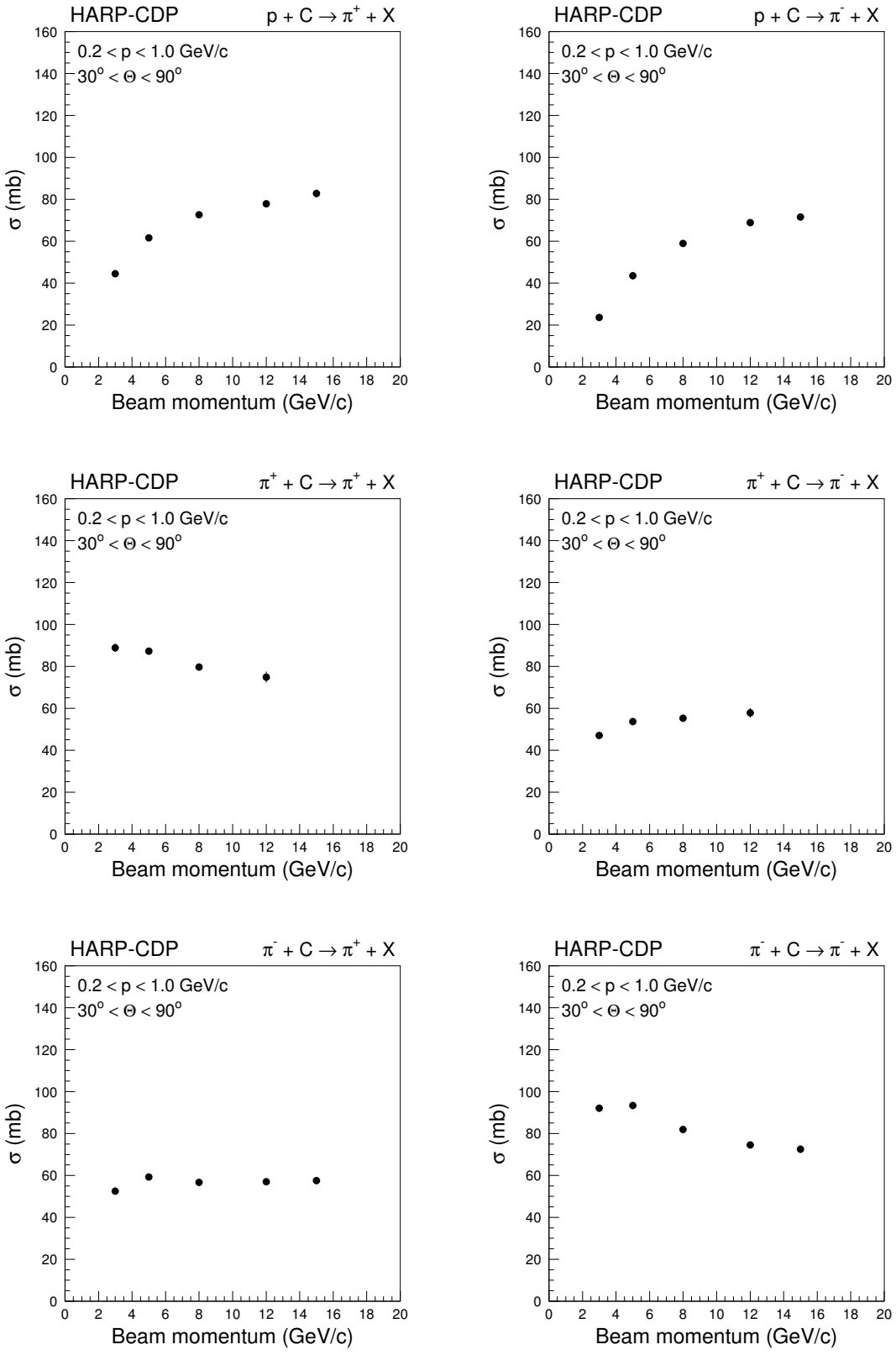

Fig. 7: Inclusive cross-sections of the production of secondary π^+'s and π^-'s, integrated over the momentum range $0.2 < p < 1.0$ GeV/c and the polar-angle range $30^\circ < \theta < 90^\circ$, from the interactions on carbon nuclei of protons (top row), π^+'s (middle row), and π^-'s (bottom row), as a function of the beam momentum; the shown errors are total errors and mostly smaller than the symbol size.

5 COMPARISON OF OUR RESULTS WITH RESULTS FROM THE HARP COLLABORATION

Figure 8 shows the comparison of our cross-sections of $\pi^{\pm}$ production by protons, π^+'s and π^-'s of 3.0 GeV/*c* and 8.0 GeV/*c* momentum, off carbon nuclei, with the ones published by the HARP Collaboration [13, 14], in the polar-angle range $20^\circ < \theta < 30^\circ$. The latter cross-sections are plotted as published, while we expressed our cross-sections in the unit used by the HARP Collaboration. The errors shown are the published total errors.

The discrepancy between our results and those published by the HARP Collaboration is evident. It shows the same pattern as observed in inclusive cross-sections off other targets that we analyzed and compared to the results of the HARP Collaboration [2–6]. We hold that the discrepancy is caused by problems in the HARP Collaboration's data analysis, discussed in detail in Refs [15–19], and summarized in the Appendix of Ref. [2].

6 COMPARISON OF CHARGED-PION PRODUCTION ON BERYLLIUM, CARBON, COPPER, TANTALUM AND LEAD

Figure 9 presents a comparison between the inclusive cross-sections of π^+ and π^- production, integrated over the secondaries' momentum range $0.2 < p < 1.0$ GeV/*c* and polar-angle range $30^\circ < \theta < 90^\circ$, in the interactions of protons, π^+ and π^-, with beryllium (A = 9.01), carbon (A = 12.01), copper (A = 63.55), tantalum (A = 181.0), and lead (A = 207.2) nuclei[1)]. The comparison employs the scaling variable $A^{2/3}$ where A is the atomic number of the respective nucleus. We note the approximately linear dependence on this scaling variable. At low beam momentum, the slope exhibits a strong dependence on beam particle type, which tends to disappear with higher beam momentum.

Figure 10 compares the 'forward multiplicity' of secondary π^+'s and π^-'s in the interaction of protons and pions with beryllium, carbon, copper, tantalum, and lead target nuclei. The forward multiplicities are averaged over the momentum range $0.2 < p < 1.0$ GeV/*c* and the polar-angle range $30^\circ < \theta < 90^\circ$. They have been obtained by dividing the measured inclusive cross-section by the total cross-section inferred from the nuclear interaction lengths and pion interaction lengths, respectively, as published by the Particle Data Group [12] and reproduced in Table 1. The errors of the forward multiplicities are dominated by a 3% systematic uncertainty.

Table 1: Nuclear and pion interactions lengths used for the calculation of pion forward multiplicities.

Nucleus	$\lambda_{\rm int}^{\rm nucl}$ [g cm^{-2}]	$\lambda_{\rm int}^{\rm pion}$ [g cm^{-2}]
Beryllium	77.8	109.9
Carbon	85.8	117.8
Copper	137.3	165.9
Tantalum	191.0	217.7
Lead	199.6	226.2

The forward multiplicities display a 'leading particle effect' that mirrors the incoming beam particle. It is also interesting that the forward multiplicity decreases with the nuclear mass at

[1)] The beryllium data with $+8.9$ GeV/*c* beam momentum [2, 3] have been scaled, by interpolation, to a beam momentum of $+8.0$ GeV/*c*.

low beam momentum but increases at high beam momentum. We interpret this as the effect of the nuclear medium on secondary pions from the primary interaction of the incoming beam particle. At low beam momentum, the secondary pions have low momentum and tend to fall below the 0.2 GeV/*c* threshold imposed in our analysis if there is more nuclear medium to be traversed before escape. At high beam momentum, the secondary pions have high enough momentum such that tertiary pions from the re-interaction of secondary pions in the nuclear medium tend to pass the 0.2 GeV/*c* threshold.

Figure 11 shows the increase of the inclusive cross-sections of π^+'s and π^-'s production by incoming protons of 8.0 GeV/*c* (in the case of beryllium target nuclei: +8.9 GeV/*c*) from the light beryllium nucleus to the heavy lead nucleus, for pions in the polar angle range $20^\circ < \theta < 30^\circ$. It is interesting to note that π^- production is slightly favoured on heavy nuclei, while π^+ production is slightly favoured on light nuclei.

Comparing the cross-sections for carbon and beryllium targets shown in Fig. 11 we note that π^- production on carbon nuclei is nearly the same as on beryllium nuclei while the production of π^+'s scales in approximate agreement with the $A^{2/3}$ law. A similar effect was observed many years ago in an experiment at JINR Dubna [20,21] with a 660 MeV/*c* proton beam[2)]. The author of Ref. [22] interprets the effect in terms of a model in which the beryllium nucleus consists of two alpha particles and a nearly free neutron, while the carbon nucleus consists of three alpha particles. The inelastic cross-section on a free neutron is expected to be much higher than on the neutrons which are tightly bound within the alpha particles. This explains the anomalously large yield of negative pions on beryllium nuclei.

[2)] An even stronger effect was observed with a 600 MeV/*c* neutron beam [22].

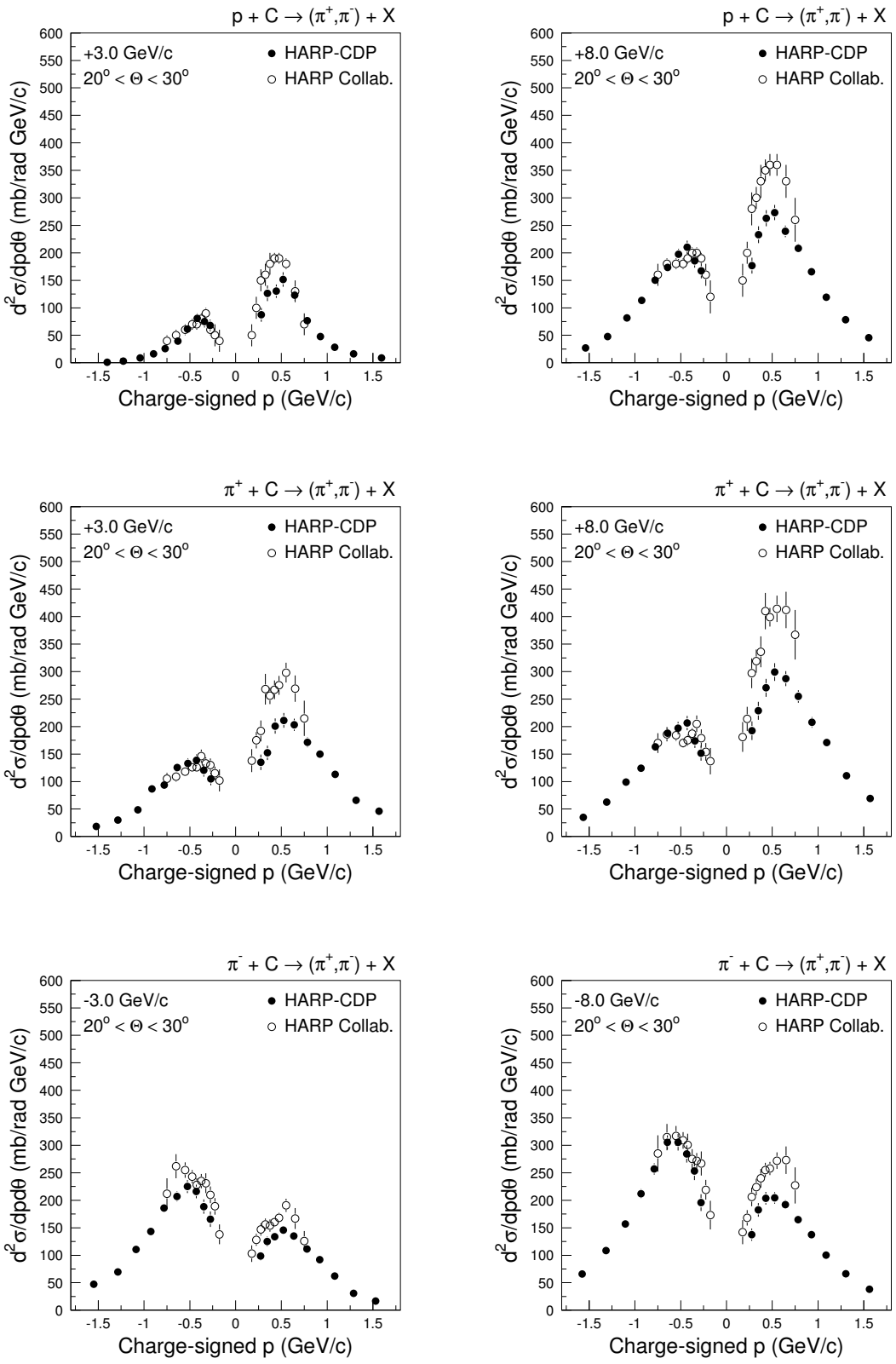

Fig. 8: Comparison of HARP–CDP cross-sections (full circles) of $\pi^{\pm}$ production by protons, π^{+}'s and π^{-}'s of 3.0 GeV/c (left panels) and 8.0 GeV/c momentum (right panels), off carbon nuclei, with the cross-sections published by the HARP Collaboration (open circles).

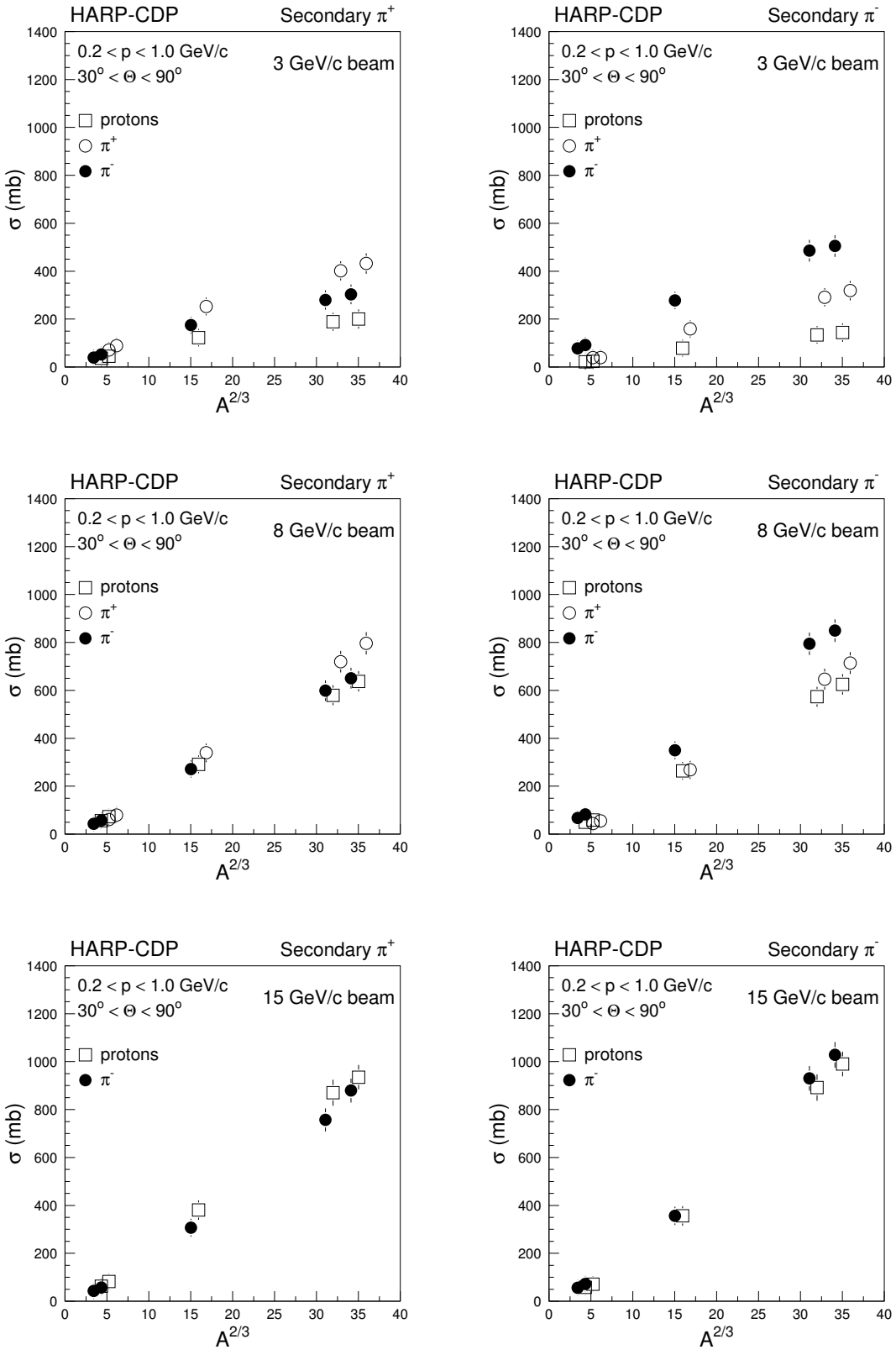

Fig. 9: Inclusive cross-sections of π^+ and π^- production by protons (open squares), π^+'s (open circles), and π^-'s (black circles), as a function of $A^{2/3}$ for, from left to right, beryllium, carbon, copper, tantalum, and lead nuclei; the cross-sections are integrated over the momentum range $0.2 < p < 1.0$ GeV/c and the polar-angle range $30^\circ < \theta < 90^\circ$; the shown errors are total errors and often smaller than the symbol size.

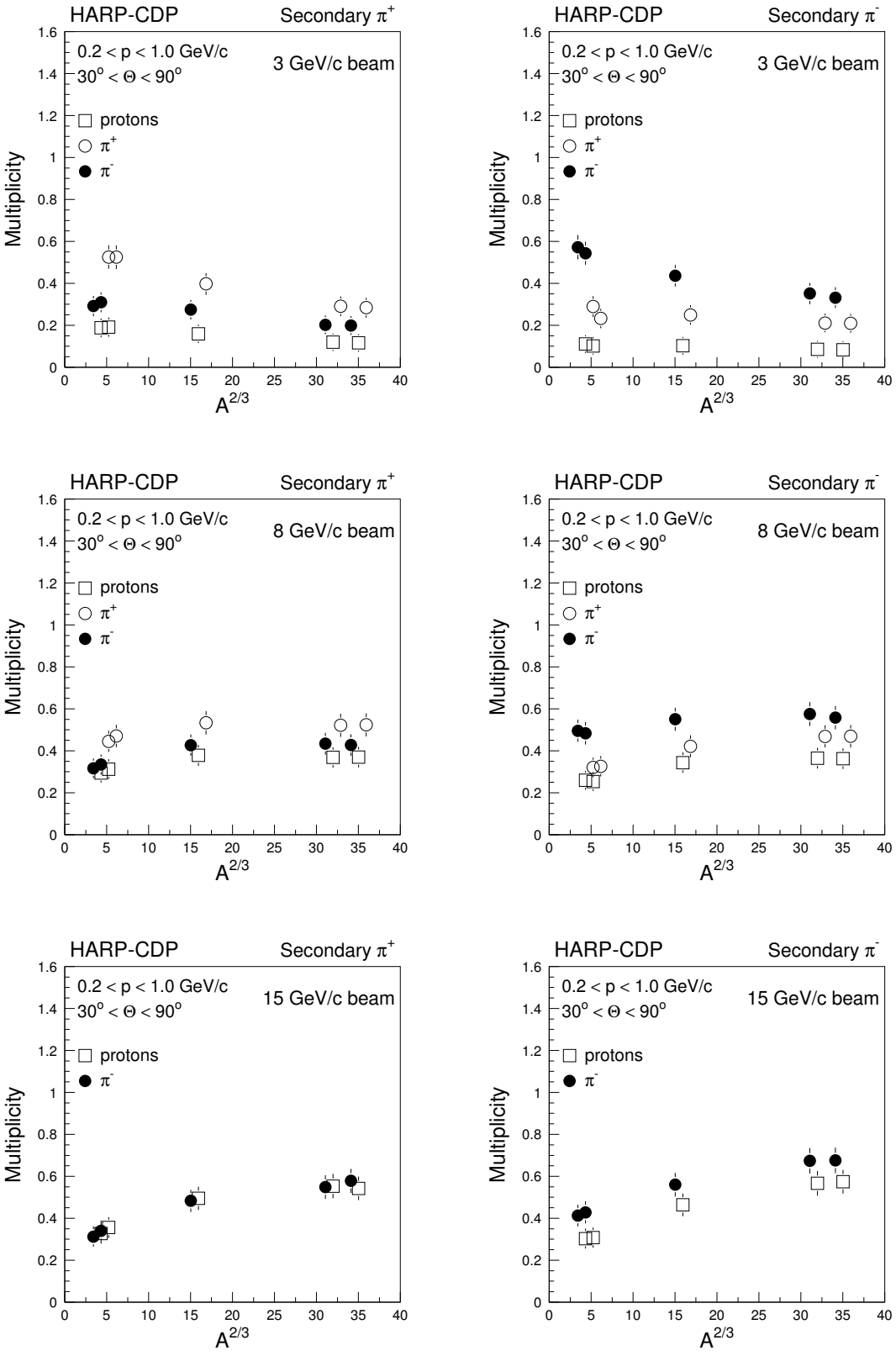

Fig. 10: Forward multiplicity of π^+'s and π^-'s produced by protons (open squares), π^+'s (open circles), and π^-'s (black circles), as a function of $A^{2/3}$ for, from left to right, beryllium, carbon, copper, tantalum, and lead nuclei; the forward multiplicity refers to the momentum range $0.2 < p < 1.0$ GeV/c and the polar-angle range $30^\circ < \theta < 90^\circ$ of secondary pions.

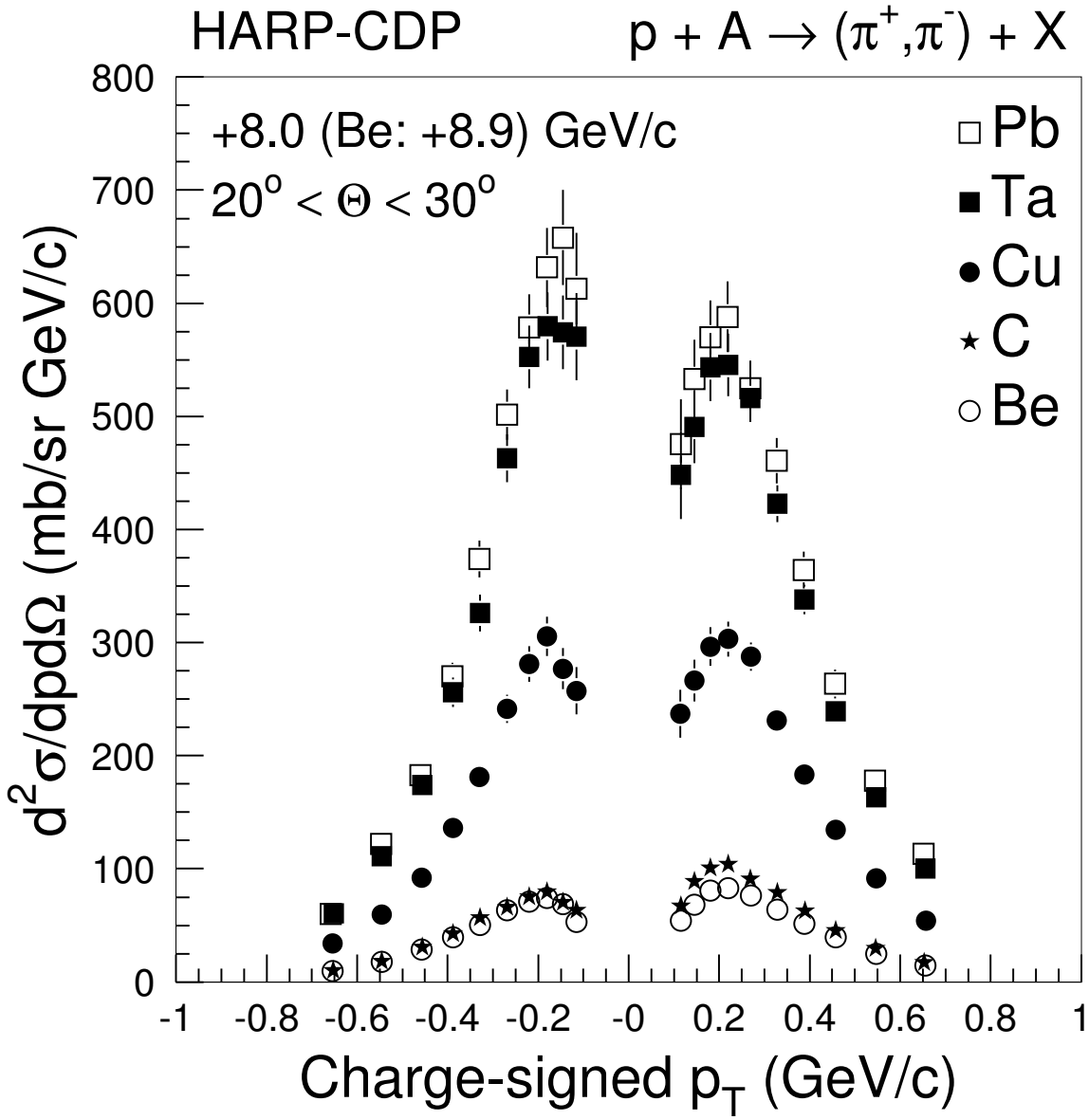

Fig. 11: Comparison of inclusive pion production cross-sections in the forward region between beryllium, carbon, copper, tantalum, and lead target nuclei, as a function of the pion momentum.

7 DEUTERON PRODUCTION

Besides pions and protons, also deuterons are produced in sizeable quantities on carbon nuclei. Up to momenta of about 1 GeV/*c*, deuterons are easily separated from protons by $\mathrm{d}E/\mathrm{d}x$.

Table 2 gives the deuteron-to-proton production ratio as a function of the momentum at the vertex, for 8 GeV/*c* beam protons, π^+'s, and π^-'s[3]. Cross-section ratios are not given if the data are scarce and the statistical error becomes comparable with the ratio itself—which is the case for deuterons at the high-momentum end of the spectrum.

The measured deuteron-to-proton production ratios are illustrated in Fig. 12, and compared with the predictions of Geant4's FRITIOF model. FRITIOF's predictions are shown for π^+ beam particles[4]. FRITIOF reproduces deuteron production reasonably well, except perhaps at large polar angles.

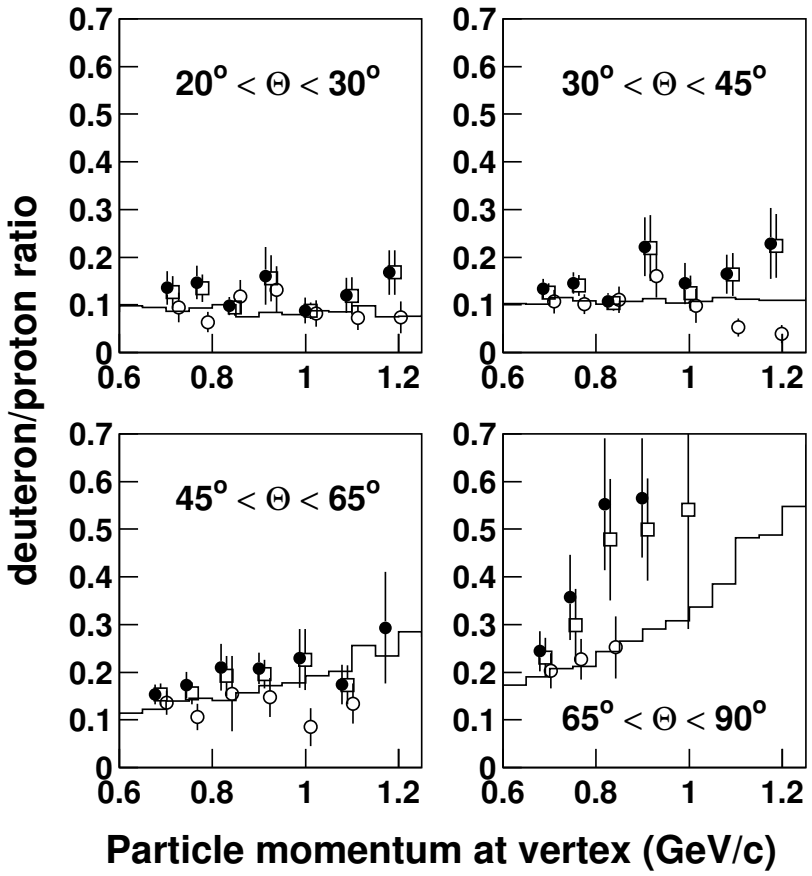

Fig. 12: Deuteron-to-proton production ratios for 8 GeV/*c* beam particles on carbon nuclei, as a function of the momentum at the vertex, for four polar-angle regions; open squares denote beam protons, open circles beam π^+'s, and full circles beam π^-'s; the full lines denotes predictions of Geant4's FRITIOF model for π^+ beam particles.

[3] We observe no appreciable dependence of the deuteron-to-proton production ratio on beam momentum.

[4] There is virtually no difference between its predictions for incoming protons, π^+'s and π^-'s.

In Fig. 13 we show, for the polar-angle region $30^\circ < \theta < 45^\circ$, how the deuteron-to-proton ratio varies with the mass of the target nucleus. The ratios are for 8 GeV/c beam protons on beryllium, carbon, copper, tantalum and lead nuclei.

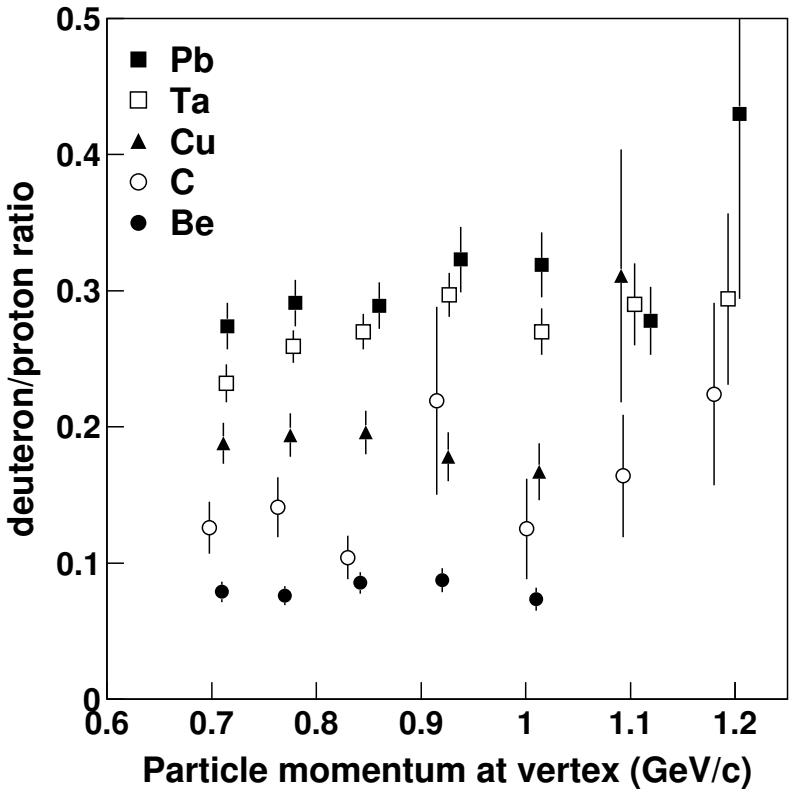

Fig. 13: Deuteron-to-proton production ratios for 8 GeV/c beam protons on beryllium, carbon, copper, tantalum and lead nuclei, as a function of the momentum at the vertex, for the polar-angle region $30^\circ < \theta < 45^\circ$.

Table 2: Ratio of deuterons to protons produced by beam protons, π^+'s and π^-'s of 8 GeV/c momentum, as a function of the particle momentum p [GeV/c] at the vertex, for differents bins of polar angle θ.

Polar angle		Beam p	Beam π^+	Beam π^-
θ	p	d/p	d/p	d/p
$20^\circ - 30^\circ$	0.663	0.146 ± 0.072	0.116 ± 0.035	0.107 ± 0.027
	0.715	0.127 ± 0.034	0.095 ± 0.031	0.136 ± 0.035
	0.778	0.135 ± 0.029	0.064 ± 0.021	0.147 ± 0.035
	0.848	0.095 ± 0.018	0.118 ± 0.035	0.098 ± 0.019
	0.926	0.156 ± 0.048	0.132 ± 0.049	0.161 ± 0.061
	1.011	0.088 ± 0.017	0.082 ± 0.028	0.088 ± 0.027
	1.100	0.119 ± 0.039	0.073 ± 0.025	0.120 ± 0.037
	1.192	0.168 ± 0.047	0.074 ± 0.033	0.168 ± 0.047
$30^\circ - 45^\circ$	0.641	0.135 ± 0.022	0.105 ± 0.037	0.140 ± 0.022
	0.698	0.126 ± 0.019	0.107 ± 0.025	0.134 ± 0.021
	0.763	0.141 ± 0.022	0.102 ± 0.021	0.146 ± 0.022
	0.837	0.104 ± 0.016	0.111 ± 0.028	0.108 ± 0.017
	0.917	0.219 ± 0.069	0.160 ± 0.045	0.222 ± 0.062
	1.003	0.125 ± 0.037	0.098 ± 0.036	0.145 ± 0.043
	1.093	0.164 ± 0.045	0.053 ± 0.019	0.165 ± 0.041
	1.187	0.224 ± 0.067	0.039 ± 0.019	0.229 ± 0.074
$45^\circ - 65^\circ$	0.630	0.131 ± 0.020	0.141 ± 0.040	0.136 ± 0.019
	0.689	0.153 ± 0.023	0.136 ± 0.025	0.153 ± 0.021
	0.756	0.156 ± 0.023	0.106 ± 0.028	0.173 ± 0.028
	0.830	0.192 ± 0.042	0.155 ± 0.079	0.210 ± 0.049
	0.912	0.196 ± 0.030	0.147 ± 0.041	0.208 ± 0.033
	0.999	0.226 ± 0.064	0.085 ± 0.040	0.229 ± 0.062
	1.090	0.173 ± 0.041	0.134 ± 0.042	0.174 ± 0.041
	1.184			0.293 ± 0.117
$65^\circ - 90^\circ$	0.635	0.174 ± 0.027	0.177 ± 0.031	0.196 ± 0.030
	0.691	0.231 ± 0.041	0.203 ± 0.037	0.244 ± 0.042
	0.756	0.298 ± 0.077	0.227 ± 0.043	0.357 ± 0.089
	0.830	0.478 ± 0.127	0.252 ± 0.065	0.552 ± 0.138
	0.911	0.499 ± 0.107		0.565 ± 0.125
	0.998	0.541 ± 0.250		
$90^\circ - 125^\circ$	0.689		0.220 ± 0.071	
	0.756	0.377 ± 0.097	0.184 ± 0.073	
	0.830	0.780 ± 0.180		0.965 ± 0.258
	0.911	0.620 ± 0.298		

8 SUMMARY

From the analysis of data from the HARP large-angle spectrometer (polar angle θ in the range $20^\circ < \theta < 125^\circ$), double-differential cross-sections $\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$ of the production of secondary protons, π^+'s, and π^-'s, and of deuterons, have been obtained. The incoming beam particles were protons and pions with momenta from ± 3 to ± 15 GeV/c, impinging on a 5% λ_{int} thick stationary carbon target.

In the same way as for the other target nuclei which we have analyzed, our cross-sections for π^+ and π^- production disagree with results of the HARP Collaboration that were obtained from the same raw data.

We have compared the inclusive carbon π^+ and π^- production cross-sections with those on beryllium, copper, tantalum, and lead and find an approximately linear dependence on the scaling variable $A^{2/3}$.

We also observe a sizeable production of deuterons off carbon nuclei that we compared to the deuteron production on beryllium, copper, tantalum, and lead.

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REFERENCES

[1] M. Apollonio *et al.*, J. Instrum. **4** (2009) P07001

[2] A. Bolshakova *et al.*, Eur. Phys. J. **C62** (2009) 293 (CERN-PH-EP-2008-022, arXiv:0901.3648)

[3] A. Bolshakova *et al.*, Eur. Phys. J. **C62** (2009) 697 (CERN-PH-EP-2008-025, arXiv:0903.2145)

[4] A. Bolshakova *et al.*, Eur. Phys. J. **C63** (2009) 549 (CERN-PH-EP-2009-009, arXiv:0906.0471)

[5] A. Bolshakova *et al.*, Eur. Phys. J. **C64** (2009) 181 (CERN-PH-EP-2009-012, arXiv:0906.3653)

[6] A. Bolshakova *et al.*, Eur. Phys. J. **C66** (2010) 57 (CERN-PH-EP-2009-025, arXiv:0912.0378v1)

[7] V. Ammosov *et al.*, Nucl. Instrum. Methods Phys. Res. **A588** (2008) 294

[8] V. Ammosov *et al.*, Nucl. Instrum. Methods Phys. Res. **A578** (2007) 119

[9] S. Agostinelli *et al.*, Nucl. Instrum. Methods Phys. Res. **A506** (2003) 250; J. Allison *et al.*, IEEE Trans. Nucl. Sci. **53** (2006) 270

[10] A. Bolshakova *et al.*, Eur. Phys. J. **C56** (2008) 323

[11] A. Bolshakova *et al.*, Tables of cross-sections of large-angle hadron production in proton– and pion–nucleus interactions VI: carbon nuclei and beam momenta from ± 3 GeV/c to ± 15 GeV/c, CERN–HARP–CDP–2010–001

[12] http://pdg.lbl.gov/2009/AtomicNuclearProperties

[13] M.G. Catanesi *et al.*, Phys. Rev. **C77** (2008) 055207 (arXiv:0805.2871)

[14] M. Apollonio *et al.*, Phys. Rev. **C80** (2009) 065207 (arXiv:0907.1428)

[15] V. Ammosov *et al.*, J. Instrum. **3** (2008) P01002
[16] V. Ammosov *et al.*, Eur. Phys. J. **C54** (2008) 169
[17] V. Ammosov *et al.*, CERN–HARP–CDP–2006–003
[18] V. Ammosov *et al.*, CERN–HARP–CDP–2006–007
[19] V. Ammosov *et al.*, CERN–HARP–CDP–2007–001
[20] A.G. Meshkovski, Ya.Ya. Shalamov, V.A. Shebanov, J. Exp. Theor. Phys. **33** (1957) 602 (in Russian)
[21] A.G. Meshkovski *et al.*, J. Exp. Theor. Phys. **31** (1956) 987 (in Russian)
[22] K.O. Oganesian, J. Exp. Theor. Phys. **54** (1968) 1273 (in Russian)

APPENDIX A: CROSS-SECTION TABLES

Table A.1: Double-differential inclusive cross-section $\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$ [mb/(GeV/c sr)] of the production of protons in p + C $\rightarrow$ p + X interactions with $+3.0$ GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees.

	$20 < \theta < 30$			$30 < \theta < 40$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.20–0.24	0.222	24.7	92.39 $\pm$ 5.08 $\pm$ 5.12			
0.24–0.30	0.271	24.9	83.64 $\pm$ 3.94 $\pm$ 4.31	0.272	34.7	71.69 $\pm$ 3.49 $\pm$ 3.42
0.30–0.36	0.332	24.8	74.65 $\pm$ 3.76 $\pm$ 3.61	0.329	35.1	78.59 $\pm$ 3.76 $\pm$ 3.43
0.36–0.42	0.391	25.1	72.47 $\pm$ 3.76 $\pm$ 3.32	0.391	35.0	63.24 $\pm$ 3.47 $\pm$ 2.90
0.42–0.50	0.461	24.9	71.82 $\pm$ 3.15 $\pm$ 2.97	0.459	35.2	53.49 $\pm$ 2.81 $\pm$ 2.40
0.50–0.60	0.552	24.9	54.18 $\pm$ 2.48 $\pm$ 2.23	0.551	34.8	45.29 $\pm$ 2.32 $\pm$ 2.11
0.60–0.72	0.661	24.8	43.97 $\pm$ 2.07 $\pm$ 2.23	0.660	35.0	34.54 $\pm$ 1.88 $\pm$ 1.78
0.72–0.90				0.804	35.0	20.43 $\pm$ 1.18 $\pm$ 1.33

	$40 < \theta < 50$			$50 < \theta < 60$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.30–0.36	0.329	45.2	78.69 $\pm$ 3.64 $\pm$ 3.10			
0.36–0.42	0.389	44.9	70.61 $\pm$ 3.54 $\pm$ 2.70	0.390	54.8	63.79 $\pm$ 3.26 $\pm$ 2.31
0.42–0.50	0.457	44.9	52.08 $\pm$ 2.73 $\pm$ 2.26	0.458	55.1	61.01 $\pm$ 2.85 $\pm$ 2.32
0.50–0.60	0.547	44.8	44.06 $\pm$ 2.32 $\pm$ 2.16	0.549	54.9	40.05 $\pm$ 2.17 $\pm$ 2.00
0.60–0.72	0.653	44.9	30.26 $\pm$ 1.80 $\pm$ 1.70	0.653	54.9	27.87 $\pm$ 1.72 $\pm$ 1.63
0.72–0.90	0.798	44.9	16.95 $\pm$ 1.11 $\pm$ 1.22	0.797	55.1	13.96 $\pm$ 1.03 $\pm$ 1.08
0.90–1.25	1.022	44.9	3.44 $\pm$ 0.34 $\pm$ 0.41			

	$60 < \theta < 75$			$75 < \theta < 90$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.42–0.50	0.460	67.2	51.99 $\pm$ 2.09 $\pm$ 1.85	0.456	81.9	37.34 $\pm$ 1.76 $\pm$ 1.57
0.50–0.60	0.546	67.0	37.33 $\pm$ 1.69 $\pm$ 1.76	0.546	81.9	21.85 $\pm$ 1.24 $\pm$ 1.19
0.60–0.72	0.656	67.0	19.19 $\pm$ 1.19 $\pm$ 1.55	0.651	81.7	8.10 $\pm$ 0.82 $\pm$ 1.03
0.72–0.90	0.795	67.1	6.19 $\pm$ 0.59 $\pm$ 0.83			

	$90 < \theta < 105$			$105 < \theta < 125$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.42–0.50	0.454	96.8	21.07 $\pm$ 1.30 $\pm$ 1.22	0.454	113.3	8.33 $\pm$ 0.72 $\pm$ 0.51
0.50–0.60	0.544	96.7	8.93 $\pm$ 0.80 $\pm$ 0.65			

Table A.2: Double-differential inclusive cross-section $\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$ [mb/(GeV/c sr)] of the production of π^+'s in p + C $\to \pi^+$ + X interactions with $+3.0$ GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees.

	$20 < \theta < 30$			$30 < \theta < 40$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.10–0.13	0.117	24.7	33.25 ± 4.06 ± 2.56	0.114	36.0	30.10 ± 3.94 ± 2.33
0.13–0.16	0.146	24.9	47.78 ± 4.53 ± 3.00	0.145	35.2	45.34 ± 4.29 ± 2.91
0.16–0.20	0.182	24.1	50.68 ± 3.86 ± 2.70	0.181	34.8	40.10 ± 3.34 ± 2.19
0.20–0.24	0.221	25.2	56.63 ± 4.09 ± 2.71	0.220	34.8	44.13 ± 3.44 ± 2.15
0.24–0.30	0.269	24.7	46.97 ± 2.93 ± 2.01	0.269	34.9	37.37 ± 2.61 ± 1.61
0.30–0.36	0.330	25.0	28.80 ± 2.33 ± 1.20	0.329	35.1	26.17 ± 2.18 ± 1.09
0.36–0.42	0.392	25.0	18.00 ± 1.83 ± 0.79	0.392	35.2	20.76 ± 1.94 ± 0.91
0.42–0.50	0.461	25.2	10.57 ± 1.19 ± 0.56	0.456	35.2	11.23 ± 1.27 ± 0.56
0.50–0.60	0.553	25.4	6.06 ± 0.75 ± 0.41	0.548	35.0	5.60 ± 0.76 ± 0.34
0.60–0.72	0.662	24.6	3.43 ± 0.46 ± 0.33	0.654	35.4	5.25 ± 0.67 ± 0.45
0.72–0.90				0.804	34.5	2.52 ± 0.32 ± 0.34

	$40 < \theta < 50$			$50 < \theta < 60$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.10–0.13	0.117	45.3	34.58 ± 4.22 ± 2.76			
0.13–0.16	0.145	44.5	35.53 ± 3.83 ± 2.24	0.147	55.9	37.82 ± 4.01 ± 2.47
0.16–0.20	0.180	44.7	38.07 ± 3.33 ± 2.06	0.179	54.7	30.32 ± 2.97 ± 1.63
0.20–0.24	0.221	44.9	42.73 ± 3.45 ± 2.09	0.219	54.8	30.48 ± 2.89 ± 1.49
0.24–0.30	0.268	45.0	29.69 ± 2.30 ± 1.28	0.264	54.9	27.07 ± 2.25 ± 1.17
0.30–0.36	0.326	44.9	22.66 ± 2.02 ± 0.95	0.327	54.9	18.55 ± 1.82 ± 0.79
0.36–0.42	0.386	45.3	14.21 ± 1.60 ± 0.63	0.389	54.2	10.10 ± 1.33 ± 0.46
0.42–0.50	0.460	44.3	9.16 ± 1.12 ± 0.44	0.458	55.5	9.88 ± 1.20 ± 0.52
0.50–0.60	0.549	44.4	6.39 ± 0.84 ± 0.38	0.542	54.6	4.45 ± 0.68 ± 0.28
0.60–0.72	0.654	43.8	2.89 ± 0.49 ± 0.23	0.644	54.8	2.66 ± 0.48 ± 0.22
0.72–0.90	0.802	44.3	1.34 ± 0.23 ± 0.15	0.753	54.9	0.59 ± 0.17 ± 0.07
0.90–1.25				1.029	54.4	0.15 ± 0.04 ± 0.03

	$60 < \theta < 75$			$75 < \theta < 90$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.13–0.16	0.145	67.6	28.61 ± 2.88 ± 1.87	0.146	81.6	21.77 ± 2.52 ± 1.45
0.16–0.20	0.180	66.7	29.12 ± 2.40 ± 1.54	0.181	82.2	26.22 ± 2.27 ± 1.38
0.20–0.24	0.219	67.0	25.88 ± 2.20 ± 1.23	0.218	82.6	21.87 ± 2.07 ± 1.05
0.24–0.30	0.265	66.5	18.17 ± 1.50 ± 0.77	0.270	82.2	14.04 ± 1.33 ± 0.63
0.30–0.36	0.327	66.7	10.38 ± 1.13 ± 0.44	0.327	82.4	8.13 ± 1.02 ± 0.40
0.36–0.42	0.387	66.8	7.03 ± 0.94 ± 0.33	0.390	82.4	5.67 ± 0.85 ± 0.34
0.42–0.50	0.462	66.2	6.22 ± 0.76 ± 0.34	0.454	83.9	2.74 ± 0.52 ± 0.20
0.50–0.60	0.547	66.5	3.34 ± 0.50 ± 0.23	0.544	80.2	0.96 ± 0.27 ± 0.09
0.60–0.72	0.659	66.3	1.32 ± 0.27 ± 0.12	0.649	81.9	0.61 ± 0.20 ± 0.07
0.72–0.90	0.795	65.1	0.35 ± 0.10 ± 0.04	0.783	78.0	0.13 ± 0.06 ± 0.02
0.90–1.25	1.005	66.0	0.04 ± 0.02 ± 0.01			

	$90 < \theta < 105$			$105 < \theta < 125$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.13–0.16	0.147	97.2	21.84 ± 2.53 ± 1.42	0.145	115.0	17.49 ± 1.95 ± 1.01
0.16–0.20	0.181	97.9	18.29 ± 1.90 ± 0.93	0.179	113.1	15.11 ± 1.51 ± 0.69
0.20–0.24	0.220	96.8	13.31 ± 1.60 ± 0.62	0.219	114.2	10.74 ± 1.26 ± 0.50
0.24–0.30	0.264	96.7	8.24 ± 1.04 ± 0.39	0.271	112.6	3.51 ± 0.58 ± 0.20
0.30–0.36	0.330	96.2	3.94 ± 0.72 ± 0.24	0.330	111.5	1.40 ± 0.38 ± 0.11
0.36–0.42	0.389	96.2	2.93 ± 0.61 ± 0.24	0.393	112.9	1.16 ± 0.34 ± 0.12
0.42–0.50	0.449	95.8	1.42 ± 0.38 ± 0.14	0.459	111.3	0.39 ± 0.16 ± 0.05
0.50–0.60	0.558	98.4	0.43 ± 0.18 ± 0.06	0.515	108.7	0.09 ± 0.07 ± 0.02

Table A.3: Double-differential inclusive cross-section $\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$ [mb/(GeV/c sr)] of the production of π^-'s in p + C $\to \pi^-$ + X interactions with $+3.0$ GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees.

	$20 < \theta < 30$			$30 < \theta < 40$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.10–0.13	0.115	24.5	26.18 ± 3.58 ± 2.06	0.116	35.3	25.40 ± 3.47 ± 2.08
0.13–0.16	0.144	25.0	28.28 ± 3.49 ± 1.97	0.144	35.1	20.25 ± 2.79 ± 1.43
0.16–0.20	0.181	25.5	29.85 ± 2.95 ± 1.72	0.180	34.7	25.31 ± 2.65 ± 1.51
0.20–0.24	0.221	24.8	23.19 ± 2.53 ± 1.22	0.217	35.0	21.56 ± 2.39 ± 1.17
0.24–0.30	0.268	25.2	14.68 ± 1.65 ± 0.70	0.267	35.0	18.47 ± 1.81 ± 0.88
0.30–0.36	0.319	24.5	9.80 ± 1.33 ± 0.49	0.329	35.2	12.76 ± 1.51 ± 0.62
0.36–0.42	0.380	25.1	6.11 ± 1.10 ± 0.36	0.385	35.1	7.73 ± 1.21 ± 0.42
0.42–0.50	0.452	25.7	3.17 ± 0.68 ± 0.21	0.450	34.9	6.04 ± 0.92 ± 0.36
0.50–0.60	0.543	26.3	1.12 ± 0.36 ± 0.10	0.544	35.2	2.04 ± 0.47 ± 0.15
0.60–0.72	0.657	27.9	0.33 ± 0.19 ± 0.04	0.659	35.9	0.85 ± 0.28 ± 0.08
0.72–0.90				0.791	34.5	0.21 ± 0.12 ± 0.03

	$40 < \theta < 50$			$50 < \theta < 60$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.10–0.13	0.115	45.3	20.93 ± 3.35 ± 1.79			
0.13–0.16	0.144	45.3	24.13 ± 3.19 ± 1.65	0.146	55.1	19.76 ± 2.96 ± 1.39
0.16–0.20	0.181	45.3	19.12 ± 2.30 ± 1.14	0.180	55.2	19.84 ± 2.36 ± 1.16
0.20–0.24	0.221	45.2	21.38 ± 2.45 ± 1.17	0.220	55.5	18.07 ± 2.23 ± 0.98
0.24–0.30	0.270	44.9	17.95 ± 1.79 ± 0.86	0.267	55.1	13.33 ± 1.56 ± 0.64
0.30–0.36	0.327	45.3	11.56 ± 1.44 ± 0.56	0.329	54.6	9.24 ± 1.28 ± 0.46
0.36–0.42	0.386	44.2	8.30 ± 1.20 ± 0.44	0.388	53.6	6.03 ± 1.04 ± 0.33
0.42–0.50	0.459	45.2	4.05 ± 0.74 ± 0.24	0.454	54.2	3.95 ± 0.75 ± 0.25
0.50–0.60	0.541	44.9	2.28 ± 0.50 ± 0.17	0.539	55.7	1.97 ± 0.46 ± 0.15
0.60–0.72	0.638	45.7	1.07 ± 0.32 ± 0.11	0.663	54.5	1.11 ± 0.32 ± 0.12
0.72–0.90	0.780	48.1	0.33 ± 0.15 ± 0.04	0.807	52.3	0.10 ± 0.07 ± 0.02

	$60 < \theta < 75$			$75 < \theta < 90$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.13–0.16	0.145	66.9	17.60 ± 2.25 ± 1.18	0.146	83.0	17.54 ± 2.27 ± 1.24
0.16–0.20	0.178	67.5	19.51 ± 1.94 ± 1.05	0.180	82.2	18.05 ± 1.88 ± 0.98
0.20–0.24	0.221	66.5	14.35 ± 1.62 ± 0.72	0.218	82.0	13.08 ± 1.55 ± 0.67
0.24–0.30	0.267	67.0	10.39 ± 1.11 ± 0.48	0.268	82.1	6.99 ± 0.91 ± 0.34
0.30–0.36	0.329	66.7	6.40 ± 0.89 ± 0.31	0.323	81.5	4.96 ± 0.79 ± 0.29
0.36–0.42	0.385	66.3	4.91 ± 0.78 ± 0.27	0.391	82.4	2.95 ± 0.60 ± 0.21
0.42–0.50	0.450	66.2	3.22 ± 0.55 ± 0.21	0.453	80.9	1.68 ± 0.40 ± 0.14
0.50–0.60	0.547	66.4	1.43 ± 0.32 ± 0.12	0.515	84.3	0.23 ± 0.13 ± 0.02
0.60–0.72	0.672	66.7	0.70 ± 0.21 ± 0.08			
0.72–0.90	0.774	65.4	0.19 ± 0.08 ± 0.03	0.761	83.7	0.09 ± 0.05 ± 0.02

	$90 < \theta < 105$			$105 < \theta < 125$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.13–0.16	0.143	97.3	15.84 ± 2.19 ± 1.12	0.144	114.0	13.32 ± 1.70 ± 0.81
0.16–0.20	0.179	97.6	15.79 ± 1.77 ± 0.88	0.177	113.2	9.57 ± 1.19 ± 0.50
0.20–0.24	0.220	97.1	9.37 ± 1.33 ± 0.51	0.218	114.8	4.84 ± 0.84 ± 0.28
0.24–0.30	0.267	96.7	5.48 ± 0.83 ± 0.31	0.273	112.6	2.62 ± 0.50 ± 0.18
0.30–0.36	0.325	96.4	3.03 ± 0.62 ± 0.22	0.329	111.9	1.07 ± 0.32 ± 0.10
0.36–0.42	0.390	95.9	1.10 ± 0.37 ± 0.10	0.387	115.9	0.34 ± 0.17 ± 0.04
0.42–0.50	0.450	96.4	1.17 ± 0.34 ± 0.14	0.465	115.8	0.19 ± 0.11 ± 0.03
0.50–0.60	0.556	93.5	0.22 ± 0.13 ± 0.04			

Table A.4: Double-differential inclusive cross-section $\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$ [mb/(GeV/c sr)] of the production of protons in π^+ + C $\to$ p + X interactions with $+3.0$ GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees.

	$20 < \theta < 30$			$30 < \theta < 40$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.20–0.24	0.221	24.6	76.55 ± 3.37 ± 4.27			
0.24–0.30	0.271	25.1	67.20 ± 2.59 ± 3.50	0.271	34.8	65.27 ± 2.44 ± 3.14
0.30–0.36	0.331	25.2	61.82 ± 2.52 ± 3.05	0.330	34.9	63.49 ± 2.47 ± 2.80
0.36–0.42	0.391	24.9	57.73 ± 2.42 ± 2.73	0.390	35.2	59.08 ± 2.45 ± 2.76
0.42–0.50	0.460	24.9	52.03 ± 1.93 ± 2.22	0.461	34.9	48.66 ± 1.94 ± 2.22
0.50–0.60	0.550	25.0	40.92 ± 1.54 ± 1.75	0.551	34.9	36.67 ± 1.50 ± 1.73
0.60–0.72	0.661	25.3	27.76 ± 1.16 ± 1.41	0.659	34.9	26.68 ± 1.17 ± 1.38
0.72–0.90				0.800	35.0	16.31 ± 0.74 ± 1.07

	$40 < \theta < 50$			$50 < \theta < 60$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.30–0.36	0.329	45.1	66.67 ± 2.45 ± 2.64			
0.36–0.42	0.389	45.1	60.76 ± 2.41 ± 2.34	0.391	55.2	60.92 ± 2.34 ± 2.23
0.42–0.50	0.458	45.2	43.58 ± 1.82 ± 1.90	0.460	55.1	46.61 ± 1.82 ± 1.79
0.50–0.60	0.546	45.1	35.59 ± 1.52 ± 1.75	0.549	55.0	31.51 ± 1.40 ± 1.61
0.60–0.72	0.655	44.9	23.30 ± 1.14 ± 1.31	0.655	55.0	20.81 ± 1.09 ± 1.25
0.72–0.90	0.797	44.7	11.66 ± 0.65 ± 0.86	0.792	54.8	10.15 ± 0.64 ± 0.84
0.90–1.25	1.025	45.0	2.72 ± 0.22 ± 0.34			

	$60 < \theta < 75$			$75 < \theta < 90$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.42–0.50	0.458	67.2	46.18 ± 1.44 ± 1.66	0.457	82.2	32.89 ± 1.21 ± 1.39
0.50–0.60	0.547	67.4	30.44 ± 1.12 ± 1.45	0.544	81.7	19.48 ± 0.86 ± 1.05
0.60–0.72	0.652	67.0	14.02 ± 0.75 ± 1.17	0.655	82.0	7.80 ± 0.58 ± 0.89
0.72–0.90	0.797	67.3	5.01 ± 0.39 ± 0.71			

	$90 < \theta < 105$			$105 < \theta < 125$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.42–0.50	0.457	97.2	21.67 ± 0.97 ± 1.24	0.456	113.8	10.69 ± 0.59 ± 0.62
0.50–0.60	0.545	96.7	12.56 ± 0.69 ± 0.88	0.541	113.2	4.10 ± 0.37 ± 0.45

Table A.5: Double-differential inclusive cross-section $\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$ [mb/(GeV/c sr)] of the production of π^+'s in π^+ + C $\to$ π^+ + X interactions with $+3.0$ GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees.

	$20 < \theta < 30$			$30 < \theta < 40$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.10–0.13	0.117	25.1	50.75 ± 3.71 ± 3.76	0.116	34.7	47.93 ± 3.48 ± 3.61
0.13–0.16	0.146	24.8	57.70 ± 3.60 ± 3.46	0.146	35.2	49.70 ± 3.25 ± 3.04
0.16–0.20	0.181	24.7	76.43 ± 3.48 ± 3.98	0.181	34.8	59.58 ± 2.95 ± 3.12
0.20–0.24	0.220	24.8	80.25 ± 3.52 ± 3.77	0.220	34.9	67.84 ± 3.12 ± 3.16
0.24–0.30	0.270	25.0	76.53 ± 2.74 ± 3.15	0.272	34.8	62.94 ± 2.46 ± 2.58
0.30–0.36	0.330	24.9	64.95 ± 2.53 ± 2.48	0.331	35.0	51.07 ± 2.21 ± 1.94
0.36–0.42	0.390	25.1	56.25 ± 2.33 ± 2.15	0.390	35.0	48.00 ± 2.12 ± 1.82
0.42–0.50	0.459	25.0	42.61 ± 1.74 ± 1.84	0.460	35.0	38.90 ± 1.68 ± 1.59
0.50–0.60	0.550	24.7	25.05 ± 1.12 ± 1.39	0.550	34.8	25.99 ± 1.18 ± 1.31
0.60–0.72	0.659	24.9	17.44 ± 0.87 ± 1.39	0.660	34.8	15.86 ± 0.83 ± 1.12
0.72–0.90				0.800	34.7	9.45 ± 0.53 ± 1.09

	$40 < \theta < 50$			$50 < \theta < 60$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.10–0.13	0.115	45.3	41.08 ± 3.41 ± 3.20			
0.13–0.16	0.144	45.3	50.13 ± 3.37 ± 3.06	0.145	55.0	43.17 ± 3.14 ± 2.75
0.16–0.20	0.180	45.1	53.18 ± 2.89 ± 2.80	0.180	54.7	46.43 ± 2.71 ± 2.44
0.20–0.24	0.220	45.0	57.07 ± 2.91 ± 2.67	0.219	55.0	50.37 ± 2.72 ± 2.34
0.24–0.30	0.269	45.1	50.54 ± 2.20 ± 2.07	0.269	54.8	41.31 ± 2.03 ± 1.68
0.30–0.36	0.330	45.0	42.73 ± 2.01 ± 1.63	0.329	54.9	33.04 ± 1.78 ± 1.27
0.36–0.42	0.390	44.8	37.73 ± 1.88 ± 1.44	0.390	54.7	28.50 ± 1.63 ± 1.12
0.42–0.50	0.456	44.8	30.37 ± 1.49 ± 1.24	0.457	54.8	22.64 ± 1.32 ± 1.02
0.50–0.60	0.546	44.8	21.29 ± 1.10 ± 1.05	0.547	54.6	13.39 ± 0.86 ± 0.70
0.60–0.72	0.653	44.7	12.41 ± 0.76 ± 0.81	0.661	54.8	9.48 ± 0.68 ± 0.65
0.72–0.90	0.795	44.3	7.24 ± 0.47 ± 0.73	0.795	54.2	5.42 ± 0.42 ± 0.54
0.90–1.25				1.015	54.4	0.79 ± 0.09 ± 0.13

	$60 < \theta < 75$			$75 < \theta < 90$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.13–0.16	0.145	67.3	39.47 ± 2.48 ± 2.53	0.146	82.8	34.55 ± 2.34 ± 2.23
0.16–0.20	0.180	67.2	41.03 ± 2.10 ± 2.13	0.179	82.3	33.54 ± 1.88 ± 1.71
0.20–0.24	0.220	67.0	39.08 ± 1.99 ± 1.78	0.220	82.3	31.25 ± 1.80 ± 1.41
0.24–0.30	0.268	67.3	30.33 ± 1.41 ± 1.21	0.269	82.2	22.31 ± 1.23 ± 0.90
0.30–0.36	0.328	67.1	25.39 ± 1.29 ± 0.97	0.330	82.1	16.34 ± 1.05 ± 0.68
0.36–0.42	0.391	66.5	20.02 ± 1.14 ± 0.81	0.388	81.6	10.97 ± 0.84 ± 0.52
0.42–0.50	0.459	66.7	15.32 ± 0.86 ± 0.72	0.459	82.2	9.71 ± 0.69 ± 0.55
0.50–0.60	0.543	66.9	10.33 ± 0.64 ± 0.62	0.545	81.5	6.25 ± 0.50 ± 0.45
0.60–0.72	0.655	66.1	5.29 ± 0.41 ± 0.42	0.652	81.5	2.87 ± 0.31 ± 0.28
0.72–0.90	0.793	66.7	2.04 ± 0.20 ± 0.22	0.789	81.2	0.83 ± 0.12 ± 0.12
0.90–1.25	0.992	66.5	0.26 ± 0.04 ± 0.05	0.992	82.3	0.07 ± 0.02 ± 0.02

	$90 < \theta < 105$			$105 < \theta < 125$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.13–0.16	0.145	97.1	28.95 ± 2.13 ± 1.82	0.144	115.1	29.64 ± 1.86 ± 1.65
0.16–0.20	0.179	97.3	31.23 ± 1.83 ± 1.52	0.180	114.0	26.16 ± 1.47 ± 1.14
0.20–0.24	0.219	97.4	25.81 ± 1.64 ± 1.12	0.219	114.4	14.70 ± 1.07 ± 0.63
0.24–0.30	0.267	97.1	16.13 ± 1.06 ± 0.67	0.265	113.5	10.29 ± 0.72 ± 0.49
0.30–0.36	0.328	96.8	9.78 ± 0.81 ± 0.49	0.325	113.2	6.04 ± 0.56 ± 0.37
0.36–0.42	0.388	96.6	6.87 ± 0.68 ± 0.42	0.387	113.8	3.73 ± 0.43 ± 0.30
0.42–0.50	0.453	97.0	4.48 ± 0.48 ± 0.35	0.456	112.8	2.31 ± 0.28 ± 0.24
0.50–0.60	0.541	96.7	2.52 ± 0.31 ± 0.25	0.532	112.9	0.70 ± 0.13 ± 0.10
0.60–0.72	0.662	96.2	0.76 ± 0.14 ± 0.11	0.649	111.9	0.21 ± 0.07 ± 0.04
0.72–0.90	0.780	95.1	0.21 ± 0.05 ± 0.05			
0.90–1.25	0.985	93.4	0.02 ± 0.01 ± 0.01			

Table A.6: Double-differential inclusive cross-section $\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$ [mb/(GeV/c sr)] of the production of π^-'s in π^+ + C $\to$ π^- + X interactions with $+3.0$ GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees.

	$20 < \theta < 30$			$30 < \theta < 40$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.10–0.13	0.116	25.4	38.91 ± 3.13 ± 2.99	0.116	35.0	32.75 ± 2.84 ± 2.58
0.13–0.16	0.145	24.6	46.04 ± 3.22 ± 2.98	0.145	35.2	39.25 ± 2.84 ± 2.55
0.16–0.20	0.181	25.0	52.31 ± 2.79 ± 2.78	0.181	34.9	40.10 ± 2.43 ± 2.20
0.20–0.24	0.219	24.9	50.16 ± 2.72 ± 2.36	0.218	34.8	41.07 ± 2.39 ± 1.99
0.24–0.30	0.270	25.0	47.19 ± 2.15 ± 1.94	0.269	34.5	36.87 ± 1.83 ± 1.55
0.30–0.36	0.328	24.9	35.47 ± 1.85 ± 1.37	0.328	34.7	30.27 ± 1.66 ± 1.20
0.36–0.42	0.388	25.2	32.35 ± 1.82 ± 1.40	0.387	35.0	27.21 ± 1.63 ± 1.12
0.42–0.50	0.454	25.2	18.20 ± 1.16 ± 0.81	0.455	35.1	16.58 ± 1.10 ± 0.74
0.50–0.60	0.541	24.9	11.27 ± 0.80 ± 0.63	0.543	34.5	9.39 ± 0.72 ± 0.52
0.60–0.72	0.648	25.2	6.82 ± 0.59 ± 0.51	0.648	35.3	5.79 ± 0.54 ± 0.41
0.72–0.90				0.779	34.8	2.32 ± 0.29 ± 0.23

	$40 < \theta < 50$			$50 < \theta < 60$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.10–0.13	0.115	44.9	34.28 ± 3.10 ± 2.84			
0.13–0.16	0.145	44.7	34.06 ± 2.71 ± 2.20	0.144	54.9	31.99 ± 2.72 ± 2.14
0.16–0.20	0.179	44.6	34.16 ± 2.29 ± 1.92	0.179	55.0	25.19 ± 1.95 ± 1.40
0.20–0.24	0.220	44.9	28.78 ± 2.04 ± 1.43	0.219	55.1	25.57 ± 1.91 ± 1.28
0.24–0.30	0.271	44.7	28.77 ± 1.64 ± 1.23	0.267	55.2	21.20 ± 1.42 ± 0.91
0.30–0.36	0.331	45.0	23.45 ± 1.48 ± 0.94	0.327	54.9	18.58 ± 1.32 ± 0.77
0.36–0.42	0.388	44.5	18.34 ± 1.31 ± 0.77	0.389	54.5	14.94 ± 1.19 ± 0.64
0.42–0.50	0.456	44.8	12.48 ± 0.94 ± 0.58	0.459	54.2	12.52 ± 0.96 ± 0.62
0.50–0.60	0.545	44.7	8.28 ± 0.68 ± 0.48	0.544	54.5	7.00 ± 0.62 ± 0.42
0.60–0.72	0.649	45.1	4.67 ± 0.48 ± 0.35	0.653	54.3	4.17 ± 0.45 ± 0.33
0.72–0.90	0.790	44.2	2.19 ± 0.26 ± 0.22	0.784	54.6	1.35 ± 0.20 ± 0.14
0.90–1.25				1.038	54.5	0.23 ± 0.05 ± 0.04

	$60 < \theta < 75$			$75 < \theta < 90$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.13–0.16	0.146	67.5	25.03 ± 1.95 ± 1.61	0.144	82.6	22.07 ± 1.87 ± 1.45
0.16–0.20	0.181	67.5	22.21 ± 1.51 ± 1.16	0.179	82.5	19.52 ± 1.43 ± 1.02
0.20–0.24	0.219	67.0	21.41 ± 1.46 ± 1.01	0.218	82.5	14.60 ± 1.20 ± 0.69
0.24–0.30	0.268	67.2	17.63 ± 1.06 ± 0.74	0.267	82.2	13.30 ± 0.92 ± 0.58
0.30–0.36	0.329	66.9	14.32 ± 0.95 ± 0.59	0.328	82.2	8.17 ± 0.74 ± 0.38
0.36–0.42	0.388	67.0	12.46 ± 0.90 ± 0.56	0.387	81.6	6.46 ± 0.65 ± 0.35
0.42–0.50	0.456	67.4	7.24 ± 0.60 ± 0.38	0.456	81.4	3.98 ± 0.44 ± 0.26
0.50–0.60	0.545	67.1	3.79 ± 0.38 ± 0.25	0.544	81.5	3.19 ± 0.35 ± 0.27
0.60–0.72	0.655	66.4	2.39 ± 0.28 ± 0.21	0.657	81.1	0.75 ± 0.15 ± 0.09
0.72–0.90	0.798	65.1	0.70 ± 0.12 ± 0.08	0.773	80.5	0.29 ± 0.07 ± 0.05
0.90–1.25	1.032	64.5	0.08 ± 0.02 ± 0.02	1.021	80.0	0.02 ± 0.01 ± 0.01

	$90 < \theta < 105$			$105 < \theta < 125$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.13–0.16	0.145	97.0	18.80 ± 1.72 ± 1.24	0.145	114.9	17.70 ± 1.45 ± 1.04
0.16–0.20	0.179	97.0	17.01 ± 1.35 ± 0.88	0.179	114.5	12.22 ± 0.99 ± 0.59
0.20–0.24	0.221	96.8	14.28 ± 1.20 ± 0.69	0.218	114.6	7.79 ± 0.78 ± 0.40
0.24–0.30	0.269	96.2	10.07 ± 0.82 ± 0.47	0.267	113.5	6.04 ± 0.55 ± 0.34
0.30–0.36	0.328	96.7	6.28 ± 0.64 ± 0.35	0.329	114.0	3.61 ± 0.43 ± 0.26
0.36–0.42	0.384	96.9	4.06 ± 0.51 ± 0.28	0.382	112.7	2.31 ± 0.33 ± 0.22
0.42–0.50	0.457	96.6	2.77 ± 0.37 ± 0.24	0.456	112.6	1.32 ± 0.22 ± 0.16
0.50–0.60	0.554	96.8	1.15 ± 0.21 ± 0.13	0.533	112.9	0.40 ± 0.09 ± 0.07
0.60–0.72	0.657	94.3	0.53 ± 0.12 ± 0.09	0.615	113.5	0.06 ± 0.03 ± 0.02
0.72–0.90	0.768	94.6	0.13 ± 0.04 ± 0.04			

Table A.7: Double-differential inclusive cross-section $\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$ [mb/(GeV/c sr)] of the production of protons in π^- + C $\to$ p + X interactions with -3.0 GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees.

	$20 < \theta < 30$			$30 < \theta < 40$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.20–0.24	0.219	25.0	55.99 ± 1.70 ± 3.18			
0.24–0.30	0.269	25.1	51.89 ± 1.36 ± 2.82	0.270	35.0	51.35 ± 1.29 ± 2.49
0.30–0.36	0.329	25.1	44.32 ± 1.26 ± 2.37	0.329	35.1	43.83 ± 1.20 ± 2.03
0.36–0.42	0.388	25.1	40.31 ± 1.21 ± 2.14	0.388	35.0	40.08 ± 1.20 ± 2.03
0.42–0.50	0.455	25.1	31.30 ± 0.89 ± 1.67	0.456	35.1	32.43 ± 0.95 ± 1.68
0.50–0.60	0.544	25.2	24.80 ± 0.71 ± 1.38	0.543	34.9	25.78 ± 0.75 ± 1.43
0.60–0.72	0.650	25.3	15.36 ± 0.51 ± 0.97	0.650	35.0	16.45 ± 0.55 ± 1.08
0.72–0.90				0.793	35.0	10.03 ± 0.36 ± 0.82

	$40 < \theta < 50$			$50 < \theta < 60$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.30–0.36	0.328	45.2	45.57 ± 1.17 ± 1.87			
0.36–0.42	0.386	45.1	39.25 ± 1.13 ± 1.61	0.386	55.0	41.75 ± 1.12 ± 1.61
0.42–0.50	0.455	45.0	27.97 ± 0.85 ± 1.44	0.454	55.0	32.55 ± 0.89 ± 1.34
0.50–0.60	0.543	45.0	22.57 ± 0.72 ± 1.36	0.541	54.9	22.20 ± 0.70 ± 1.27
0.60–0.72	0.648	45.0	16.53 ± 0.58 ± 1.14	0.647	55.0	13.96 ± 0.53 ± 0.98
0.72–0.90	0.787	45.1	8.17 ± 0.33 ± 0.72	0.785	54.7	6.84 ± 0.32 ± 0.65
0.90–1.25	1.007	44.8	1.90 ± 0.11 ± 0.26			

	$60 < \theta < 75$			$75 < \theta < 90$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.42–0.50	0.460	67.4	31.85 ± 0.70 ± 1.17	0.459	82.0	23.48 ± 0.58 ± 1.05
0.50–0.60	0.549	67.1	22.17 ± 0.56 ± 1.15	0.547	82.0	15.25 ± 0.45 ± 0.84
0.60–0.72	0.659	67.2	10.10 ± 0.39 ± 1.06			

	$90 < \theta < 105$			$105 < \theta < 125$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.42–0.50	0.459	96.8	15.07 ± 0.47 ± 0.88	0.457	113.0	7.78 ± 0.30 ± 0.45
0.50–0.60	0.547	96.7	8.80 ± 0.34 ± 0.63	0.546	113.5	3.23 ± 0.19 ± 0.37

Table A.8: Double-differential inclusive cross-section $\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$ [mb/(GeV/c sr)] of the production of π^+'s in π^- + C $\to$ π^+ + X interactions with -3.0 GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees.

	$20 < \theta < 30$			$30 < \theta < 40$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.10–0.13	0.116	24.9	37.25 ± 1.77 ± 2.74	0.116	34.9	32.24 ± 1.62 ± 2.48
0.13–0.16	0.146	24.9	47.26 ± 1.87 ± 2.93	0.145	35.0	35.74 ± 1.59 ± 2.24
0.16–0.20	0.180	24.9	50.61 ± 1.59 ± 2.68	0.180	34.8	39.56 ± 1.41 ± 2.12
0.20–0.24	0.220	24.9	54.96 ± 1.68 ± 2.64	0.219	35.0	43.19 ± 1.44 ± 2.07
0.24–0.30	0.269	25.0	50.73 ± 1.30 ± 2.14	0.269	34.8	43.70 ± 1.17 ± 1.83
0.30–0.36	0.328	24.9	42.10 ± 1.16 ± 1.69	0.328	34.7	37.11 ± 1.09 ± 1.46
0.36–0.42	0.387	24.9	34.78 ± 1.06 ± 1.52	0.387	34.7	31.01 ± 1.00 ± 1.24
0.42–0.50	0.455	24.9	23.53 ± 0.74 ± 1.31	0.456	34.7	22.14 ± 0.73 ± 1.03
0.50–0.60	0.542	24.9	11.59 ± 0.42 ± 0.94	0.542	34.7	13.07 ± 0.47 ± 0.85
0.60–0.72	0.649	25.1	6.31 ± 0.28 ± 0.78	0.648	35.1	5.91 ± 0.28 ± 0.60
0.72–0.90				0.788	34.8	2.84 ± 0.16 ± 0.50

	$40 < \theta < 50$			$50 < \theta < 60$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.10–0.13	0.115	45.1	27.73 ± 1.59 ± 2.18			
0.13–0.16	0.145	45.1	33.25 ± 1.55 ± 2.09	0.145	54.7	27.43 ± 1.43 ± 1.79
0.16–0.20	0.179	44.7	35.57 ± 1.33 ± 1.92	0.179	54.8	30.85 ± 1.27 ± 1.66
0.20–0.24	0.220	45.0	36.11 ± 1.33 ± 1.76	0.219	54.8	26.77 ± 1.15 ± 1.31
0.24–0.30	0.268	44.7	31.93 ± 1.01 ± 1.35	0.268	54.8	23.22 ± 0.87 ± 0.99
0.30–0.36	0.328	44.8	26.90 ± 0.94 ± 1.08	0.327	54.7	20.32 ± 0.80 ± 0.83
0.36–0.42	0.386	44.8	19.85 ± 0.78 ± 0.81	0.386	54.7	17.44 ± 0.76 ± 0.75
0.42–0.50	0.453	44.8	16.03 ± 0.63 ± 0.71	0.453	54.6	11.91 ± 0.54 ± 0.54
0.50–0.60	0.539	44.8	10.24 ± 0.44 ± 0.57	0.539	54.7	7.72 ± 0.38 ± 0.44
0.60–0.72	0.648	44.5	6.05 ± 0.30 ± 0.48	0.647	54.6	4.10 ± 0.25 ± 0.32
0.72–0.90	0.783	44.6	2.13 ± 0.14 ± 0.28	0.784	55.0	1.51 ± 0.12 ± 0.18
0.90–1.25				0.987	54.6	0.27 ± 0.03 ± 0.06

	$60 < \theta < 75$			$75 < \theta < 90$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.13–0.16	0.146	67.2	24.29 ± 1.13 ± 1.59	0.145	82.3	18.63 ± 0.97 ± 1.24
0.16–0.20	0.179	67.3	24.24 ± 0.91 ± 1.29	0.181	82.2	20.41 ± 0.84 ± 1.07
0.20–0.24	0.220	67.1	21.24 ± 0.82 ± 1.01	0.221	82.2	16.67 ± 0.74 ± 0.79
0.24–0.30	0.270	67.0	18.38 ± 0.63 ± 0.77	0.270	82.5	13.44 ± 0.55 ± 0.58
0.30–0.36	0.330	66.8	13.98 ± 0.55 ± 0.57	0.328	82.1	10.84 ± 0.50 ± 0.49
0.36–0.42	0.390	67.1	12.02 ± 0.51 ± 0.52	0.389	81.8	7.19 ± 0.40 ± 0.37
0.42–0.50	0.459	67.3	8.37 ± 0.37 ± 0.42	0.461	81.9	5.01 ± 0.28 ± 0.30
0.50–0.60	0.548	66.6	5.25 ± 0.26 ± 0.33	0.549	81.5	2.85 ± 0.19 ± 0.22
0.60–0.72	0.660	66.9	2.41 ± 0.15 ± 0.21	0.656	81.0	1.35 ± 0.11 ± 0.14
0.72–0.90	0.799	67.1	0.83 ± 0.07 ± 0.10	0.790	81.3	0.41 ± 0.05 ± 0.06
0.90–1.25	1.042	66.5	0.14 ± 0.02 ± 0.03	1.040	82.2	0.04 ± 0.01 ± 0.02

	$90 < \theta < 105$			$105 < \theta < 125$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.13–0.16	0.145	97.5	17.35 ± 0.95 ± 1.14	0.145	114.7	15.90 ± 0.79 ± 0.93
0.16–0.20	0.179	97.2	17.92 ± 0.80 ± 0.91	0.179	114.0	15.27 ± 0.64 ± 0.71
0.20–0.24	0.221	96.8	15.03 ± 0.72 ± 0.70	0.219	114.2	9.37 ± 0.49 ± 0.43
0.24–0.30	0.269	97.0	9.15 ± 0.45 ± 0.41	0.268	114.0	6.03 ± 0.32 ± 0.31
0.30–0.36	0.330	96.6	6.77 ± 0.39 ± 0.35	0.330	113.4	3.83 ± 0.25 ± 0.25
0.36–0.42	0.390	96.2	4.89 ± 0.33 ± 0.32	0.387	114.7	1.80 ± 0.16 ± 0.16
0.42–0.50	0.459	96.7	2.79 ± 0.20 ± 0.22	0.457	112.4	1.15 ± 0.12 ± 0.12
0.50–0.60	0.545	96.1	1.54 ± 0.14 ± 0.16	0.545	112.5	0.32 ± 0.05 ± 0.05
0.60–0.72	0.657	95.7	0.64 ± 0.07 ± 0.10	0.647	111.9	0.09 ± 0.02 ± 0.02
0.72–0.90	0.808	96.2	0.13 ± 0.02 ± 0.03	0.798	110.8	0.02 ± 0.01 ± 0.01
0.90–1.25	1.071	97.6	0.02 ± 0.01 ± 0.01			

Table A.9: Double-differential inclusive cross-section $\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$ [mb/(GeV/c sr)] of the production of π^-'s in π^- + C $\to \pi^-$ + X interactions with -3.0 GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees.

	$20 < \theta < 30$			$30 < \theta < 40$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.10–0.13	0.116	25.0	62.41 ± 2.39 ± 4.71	0.115	35.1	50.80 ± 2.13 ± 3.88
0.13–0.16	0.146	24.8	71.53 ± 2.33 ± 4.36	0.146	35.0	60.90 ± 2.10 ± 3.77
0.16–0.20	0.181	24.8	81.94 ± 2.09 ± 4.23	0.180	34.8	69.99 ± 1.91 ± 3.70
0.20–0.24	0.221	24.9	85.15 ± 2.10 ± 3.90	0.220	34.9	69.40 ± 1.84 ± 3.23
0.24–0.30	0.270	24.9	78.31 ± 1.63 ± 3.12	0.270	34.8	65.80 ± 1.46 ± 2.65
0.30–0.36	0.330	25.0	70.07 ± 1.54 ± 2.60	0.331	34.8	56.43 ± 1.35 ± 2.10
0.36–0.42	0.391	25.0	54.05 ± 1.34 ± 2.03	0.391	34.9	48.22 ± 1.25 ± 1.82
0.42–0.50	0.460	25.0	41.60 ± 1.02 ± 1.75	0.459	34.8	35.68 ± 0.93 ± 1.48
0.50–0.60	0.548	25.2	26.06 ± 0.72 ± 1.37	0.549	34.9	25.06 ± 0.70 ± 1.28
0.60–0.72	0.660	25.2	17.74 ± 0.56 ± 1.26	0.658	35.0	16.05 ± 0.52 ± 1.08
0.72–0.90				0.803	34.9	10.30 ± 0.37 ± 1.03

	$40 < \theta < 50$			$50 < \theta < 60$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.10–0.13	0.116	44.8	43.11 ± 1.97 ± 3.37			
0.13–0.16	0.146	45.1	53.67 ± 2.02 ± 3.33	0.146	55.1	47.35 ± 1.90 ± 3.03
0.16–0.20	0.180	44.9	56.61 ± 1.71 ± 3.01	0.181	54.9	49.47 ± 1.63 ± 2.63
0.20–0.24	0.221	44.9	58.27 ± 1.73 ± 2.78	0.220	55.0	46.69 ± 1.52 ± 2.19
0.24–0.30	0.271	44.8	53.21 ± 1.32 ± 2.16	0.270	54.6	41.83 ± 1.18 ± 1.70
0.30–0.36	0.332	44.7	44.87 ± 1.20 ± 1.69	0.331	54.9	34.51 ± 1.07 ± 1.31
0.36–0.42	0.392	44.8	37.63 ± 1.12 ± 1.45	0.393	54.8	25.79 ± 0.91 ± 1.02
0.42–0.50	0.462	44.7	29.24 ± 0.84 ± 1.25	0.463	54.7	23.76 ± 0.77 ± 1.06
0.50–0.60	0.553	45.0	20.34 ± 0.62 ± 1.09	0.553	54.7	15.36 ± 0.55 ± 0.85
0.60–0.72	0.663	44.9	14.18 ± 0.49 ± 1.01	0.660	54.8	9.86 ± 0.41 ± 0.72
0.72–0.90	0.809	44.9	7.30 ± 0.30 ± 0.74	0.810	54.7	4.73 ± 0.24 ± 0.48
0.90–1.25				1.053	54.7	0.87 ± 0.06 ± 0.14

	$60 < \theta < 75$			$75 < \theta < 90$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.13–0.16	0.145	67.3	42.74 ± 1.50 ± 2.63	0.145	82.6	34.25 ± 1.34 ± 2.14
0.16–0.20	0.179	67.1	43.48 ± 1.25 ± 2.18	0.180	82.2	37.29 ± 1.16 ± 1.84
0.20–0.24	0.219	67.1	39.42 ± 1.16 ± 1.75	0.218	82.1	32.90 ± 1.07 ± 1.43
0.24–0.30	0.268	67.1	32.74 ± 0.85 ± 1.28	0.268	82.2	25.21 ± 0.76 ± 1.00
0.30–0.36	0.328	66.9	25.27 ± 0.75 ± 0.96	0.327	81.6	16.36 ± 0.61 ± 0.68
0.36–0.42	0.387	66.9	20.25 ± 0.67 ± 0.83	0.386	81.7	12.33 ± 0.52 ± 0.60
0.42–0.50	0.457	66.9	16.23 ± 0.52 ± 0.79	0.456	81.5	8.87 ± 0.38 ± 0.53
0.50–0.60	0.542	66.7	11.47 ± 0.39 ± 0.71	0.541	81.7	5.76 ± 0.28 ± 0.45
0.60–0.72	0.648	66.4	5.73 ± 0.26 ± 0.47	0.650	81.7	2.84 ± 0.18 ± 0.29
0.72–0.90	0.791	66.0	2.54 ± 0.14 ± 0.28	0.780	81.5	0.76 ± 0.06 ± 0.11
0.90–1.25	1.008	66.4	0.28 ± 0.02 ± 0.06	1.005	81.7	0.07 ± 0.01 ± 0.02

	$90 < \theta < 105$			$105 < \theta < 125$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.13–0.16	0.145	97.3	32.54 ± 1.30 ± 2.05	0.145	114.8	31.32 ± 1.12 ± 1.70
0.16–0.20	0.179	97.2	32.42 ± 1.11 ± 1.60	0.179	113.8	24.11 ± 0.82 ± 1.05
0.20–0.24	0.218	97.1	23.45 ± 0.91 ± 1.01	0.218	113.5	16.31 ± 0.66 ± 0.72
0.24–0.30	0.267	96.8	17.41 ± 0.63 ± 0.73	0.267	113.5	9.93 ± 0.41 ± 0.51
0.30–0.36	0.327	97.0	11.27 ± 0.51 ± 0.57	0.325	113.6	5.54 ± 0.31 ± 0.38
0.36–0.42	0.387	96.5	7.79 ± 0.41 ± 0.50	0.385	113.2	3.51 ± 0.24 ± 0.31
0.42–0.50	0.456	96.8	5.30 ± 0.30 ± 0.44	0.452	112.1	1.91 ± 0.15 ± 0.22
0.50–0.60	0.543	96.1	2.57 ± 0.18 ± 0.28	0.544	112.1	0.81 ± 0.09 ± 0.13
0.60–0.72	0.638	96.1	0.94 ± 0.10 ± 0.14	0.656	111.6	0.13 ± 0.03 ± 0.03
0.72–0.90	0.786	96.0	0.21 ± 0.03 ± 0.05			

Table A.10: Double-differential inclusive cross-section $\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$ [mb/(GeV/c sr)] of the production of protons in p + C $\rightarrow$ p + X interactions with $+5.0$ GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees.

	$20 < \theta < 30$			$30 < \theta < 40$		
p_T	$\langle p_\mathrm{T} \rangle$	$\langle \theta \rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T} \rangle$	$\langle \theta \rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.20–0.24	0.220	24.9	76.36 $\pm$ 2.02 $\pm$ 4.26			
0.24–0.30	0.269	24.9	73.93 $\pm$ 1.63 $\pm$ 3.89	0.271	35.0	72.39 $\pm$ 1.54 $\pm$ 3.51
0.30–0.36	0.329	25.0	67.44 $\pm$ 1.56 $\pm$ 3.43	0.329	34.9	68.98 $\pm$ 1.52 $\pm$ 3.08
0.36–0.42	0.390	25.1	60.92 $\pm$ 1.49 $\pm$ 3.08	0.390	35.0	57.19 $\pm$ 1.45 $\pm$ 2.87
0.42–0.50	0.459	25.0	55.57 $\pm$ 1.21 $\pm$ 2.66	0.459	34.9	46.77 $\pm$ 1.14 $\pm$ 2.36
0.50–0.60	0.548	24.9	47.52 $\pm$ 0.99 $\pm$ 2.46	0.547	34.9	41.11 $\pm$ 0.96 $\pm$ 2.17
0.60–0.72	0.656	24.9	38.45 $\pm$ 0.80 $\pm$ 2.29	0.655	35.0	30.42 $\pm$ 0.75 $\pm$ 1.75
0.72–0.90				0.801	34.8	19.56 $\pm$ 0.49 $\pm$ 1.39

	$40 < \theta < 50$			$50 < \theta < 60$		
p_T	$\langle p_\mathrm{T} \rangle$	$\langle \theta \rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T} \rangle$	$\langle \theta \rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.30–0.36	0.330	45.0	64.79 $\pm$ 1.43 $\pm$ 2.68			
0.36–0.42	0.389	45.0	55.03 $\pm$ 1.35 $\pm$ 2.20	0.389	54.9	56.01 $\pm$ 1.32 $\pm$ 2.18
0.42–0.50	0.459	45.0	47.50 $\pm$ 1.15 $\pm$ 2.19	0.459	55.1	47.52 $\pm$ 1.09 $\pm$ 1.88
0.50–0.60	0.548	45.0	36.40 $\pm$ 0.92 $\pm$ 2.02	0.547	55.0	36.21 $\pm$ 0.91 $\pm$ 1.96
0.60–0.72	0.655	45.1	25.80 $\pm$ 0.71 $\pm$ 1.53	0.655	54.9	23.44 $\pm$ 0.68 $\pm$ 1.53
0.72–0.90	0.799	44.9	16.69 $\pm$ 0.48 $\pm$ 1.23	0.799	54.8	12.93 $\pm$ 0.44 $\pm$ 1.09
0.90–1.25	1.032	44.8	5.78 $\pm$ 0.20 $\pm$ 0.59	1.028	54.6	3.34 $\pm$ 0.16 $\pm$ 0.45

	$60 < \theta < 75$			$75 < \theta < 90$		
p_T	$\langle p_\mathrm{T} \rangle$	$\langle \theta \rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T} \rangle$	$\langle \theta \rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.42–0.50	0.460	67.2	48.16 $\pm$ 0.88 $\pm$ 1.76	0.460	81.9	34.22 $\pm$ 0.74 $\pm$ 1.45
0.50–0.60	0.550	67.2	32.85 $\pm$ 0.70 $\pm$ 1.59	0.549	81.9	21.70 $\pm$ 0.55 $\pm$ 1.19
0.60–0.72	0.658	66.9	17.55 $\pm$ 0.50 $\pm$ 1.47	0.656	81.5	7.94 $\pm$ 0.36 $\pm$ 1.08
0.72–0.90	0.801	66.8	6.89 $\pm$ 0.27 $\pm$ 0.90			

	$90 < \theta < 105$			$105 < \theta < 125$		
p_T	$\langle p_\mathrm{T} \rangle$	$\langle \theta \rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T} \rangle$	$\langle \theta \rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.42–0.50	0.460	96.8	19.08 $\pm$ 0.54 $\pm$ 1.12	0.458	113.2	9.04 $\pm$ 0.33 $\pm$ 0.54
0.50–0.60	0.549	96.4	10.34 $\pm$ 0.38 $\pm$ 0.76	0.544	113.4	2.59 $\pm$ 0.19 $\pm$ 0.36

Table A.11: Double-differential inclusive cross-section $\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$ [mb/(GeV/c sr)] of the production of π^+'s in p + C $\to \pi^+$ + X interactions with $+5.0$ GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees.

	$20 < \theta < 30$			$30 < \theta < 40$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.10–0.13	0.116	25.0	55.24 ± 2.29 ± 4.01	0.115	34.9	50.29 ± 2.22 ± 3.85
0.13–0.16	0.145	24.8	68.05 ± 2.32 ± 4.09	0.146	34.8	53.06 ± 2.06 ± 3.22
0.16–0.20	0.180	24.7	77.37 ± 2.09 ± 4.07	0.181	34.8	56.84 ± 1.79 ± 2.98
0.20–0.24	0.220	24.9	77.31 ± 2.03 ± 3.66	0.220	34.7	56.43 ± 1.72 ± 2.66
0.24–0.30	0.269	24.8	65.47 ± 1.51 ± 2.76	0.270	34.9	50.67 ± 1.33 ± 2.12
0.30–0.36	0.329	25.0	56.14 ± 1.39 ± 2.26	0.329	34.8	40.18 ± 1.17 ± 1.60
0.36–0.42	0.389	25.0	42.99 ± 1.21 ± 1.84	0.388	34.8	29.69 ± 0.99 ± 1.20
0.42–0.50	0.459	24.9	29.36 ± 0.87 ± 1.65	0.456	34.7	24.78 ± 0.81 ± 1.16
0.50–0.60	0.547	25.0	16.11 ± 0.53 ± 1.31	0.547	34.9	14.40 ± 0.52 ± 0.94
0.60–0.72	0.655	25.0	8.63 ± 0.33 ± 1.08	0.656	34.6	6.72 ± 0.30 ± 0.68
0.72–0.90				0.799	34.7	3.58 ± 0.16 ± 0.61

	$40 < \theta < 50$			$50 < \theta < 60$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.10–0.13	0.115	44.9	41.78 ± 2.07 ± 3.33			
0.13–0.16	0.145	44.8	43.22 ± 1.84 ± 2.68	0.145	54.8	37.58 ± 1.77 ± 2.45
0.16–0.20	0.180	44.8	47.03 ± 1.62 ± 2.52	0.180	55.0	39.01 ± 1.49 ± 2.12
0.20–0.24	0.220	44.8	44.42 ± 1.53 ± 2.15	0.220	54.8	32.85 ± 1.31 ± 1.63
0.24–0.30	0.269	44.8	37.56 ± 1.15 ± 1.59	0.269	54.6	28.69 ± 1.00 ± 1.24
0.30–0.36	0.329	44.8	31.95 ± 1.04 ± 1.27	0.328	54.6	23.37 ± 0.91 ± 0.95
0.36–0.42	0.389	44.8	26.05 ± 0.97 ± 1.07	0.388	55.0	19.56 ± 0.85 ± 0.84
0.42–0.50	0.458	44.6	18.64 ± 0.71 ± 0.83	0.458	54.8	13.93 ± 0.60 ± 0.66
0.50–0.60	0.547	44.7	11.23 ± 0.47 ± 0.63	0.545	55.0	7.64 ± 0.39 ± 0.46
0.60–0.72	0.654	44.6	5.91 ± 0.30 ± 0.48	0.653	54.6	4.43 ± 0.27 ± 0.36
0.72–0.90	0.794	44.6	2.68 ± 0.16 ± 0.35	0.793	54.5	1.81 ± 0.14 ± 0.21
0.90–1.25				1.018	54.3	0.48 ± 0.04 ± 0.09

	$60 < \theta < 75$			$75 < \theta < 90$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.13–0.16	0.146	67.5	29.51 ± 1.27 ± 1.90	0.145	82.7	26.26 ± 1.21 ± 1.73
0.16–0.20	0.180	67.2	31.70 ± 1.08 ± 1.68	0.180	82.4	25.51 ± 0.99 ± 1.33
0.20–0.24	0.220	67.2	28.43 ± 1.02 ± 1.35	0.219	82.1	22.92 ± 0.92 ± 1.06
0.24–0.30	0.269	66.8	20.28 ± 0.69 ± 0.84	0.268	82.2	17.21 ± 0.64 ± 0.72
0.30–0.36	0.330	67.0	15.85 ± 0.62 ± 0.65	0.328	81.7	10.62 ± 0.50 ± 0.48
0.36–0.42	0.390	66.7	11.95 ± 0.53 ± 0.53	0.388	81.2	6.66 ± 0.40 ± 0.35
0.42–0.50	0.460	67.0	8.27 ± 0.38 ± 0.43	0.459	81.5	4.70 ± 0.29 ± 0.29
0.50–0.60	0.548	66.3	5.15 ± 0.26 ± 0.34	0.545	81.7	2.80 ± 0.20 ± 0.22
0.60–0.72	0.658	66.0	2.72 ± 0.18 ± 0.24	0.659	80.4	1.34 ± 0.13 ± 0.14
0.72–0.90	0.800	66.8	1.04 ± 0.09 ± 0.13	0.794	80.8	0.39 ± 0.05 ± 0.06
0.90–1.25	1.026	65.7	0.19 ± 0.02 ± 0.04	1.020	82.2	0.04 ± 0.01 ± 0.02

	$90 < \theta < 105$			$105 < \theta < 125$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.13–0.16	0.146	97.1	27.43 ± 1.29 ± 1.92	0.145	114.3	20.44 ± 0.91 ± 1.17
0.16–0.20	0.180	97.1	24.31 ± 0.98 ± 1.27	0.179	113.7	16.16 ± 0.68 ± 0.75
0.20–0.24	0.219	97.4	17.12 ± 0.80 ± 0.82	0.218	113.7	10.87 ± 0.55 ± 0.52
0.24–0.30	0.268	97.1	10.43 ± 0.51 ± 0.50	0.269	113.3	5.86 ± 0.32 ± 0.31
0.30–0.36	0.329	96.7	6.39 ± 0.40 ± 0.37	0.325	113.8	3.02 ± 0.23 ± 0.21
0.36–0.42	0.391	96.6	3.36 ± 0.28 ± 0.24	0.388	112.3	1.86 ± 0.19 ± 0.17
0.42–0.50	0.458	96.7	2.51 ± 0.21 ± 0.21	0.458	111.8	0.82 ± 0.11 ± 0.10
0.50–0.60	0.547	96.1	1.27 ± 0.14 ± 0.14	0.541	114.0	0.27 ± 0.05 ± 0.05
0.60–0.72	0.655	95.6	0.50 ± 0.07 ± 0.08	0.655	112.4	0.05 ± 0.02 ± 0.02
0.72–0.90	0.801	94.7	0.07 ± 0.02 ± 0.02			

Table A.12: Double-differential inclusive cross-section $\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$ [mb/(GeV/c sr)] of the production of π^-'s in p + C $\to \pi^-$ + X interactions with $+5.0$ GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees.

	$20 < \theta < 30$			$30 < \theta < 40$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.10–0.13	0.115	25.1	44.37 ± 1.98 ± 3.36	0.115	34.9	36.47 ± 1.80 ± 2.89
0.13–0.16	0.145	24.7	47.23 ± 1.87 ± 2.98	0.145	34.9	45.64 ± 1.90 ± 3.01
0.16–0.20	0.179	24.6	49.82 ± 1.59 ± 2.69	0.179	34.8	40.47 ± 1.45 ± 2.24
0.20–0.24	0.220	24.7	48.96 ± 1.57 ± 2.37	0.220	34.8	39.47 ± 1.42 ± 1.94
0.24–0.30	0.268	24.8	40.08 ± 1.16 ± 1.70	0.269	34.7	30.82 ± 0.99 ± 1.33
0.30–0.36	0.329	25.1	30.67 ± 1.01 ± 1.25	0.329	34.7	26.68 ± 0.95 ± 1.10
0.36–0.42	0.388	25.3	21.85 ± 0.86 ± 0.91	0.389	35.0	20.54 ± 0.83 ± 0.88
0.42–0.50	0.458	25.0	16.34 ± 0.67 ± 0.81	0.456	34.9	15.46 ± 0.64 ± 0.75
0.50–0.60	0.545	25.2	7.97 ± 0.40 ± 0.47	0.547	35.0	7.72 ± 0.39 ± 0.45
0.60–0.72	0.653	25.6	3.63 ± 0.25 ± 0.29	0.654	34.9	4.11 ± 0.26 ± 0.32
0.72–0.90				0.794	34.6	1.70 ± 0.14 ± 0.17

	$40 < \theta < 50$			$50 < \theta < 60$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.10–0.13	0.115	44.8	31.98 ± 1.80 ± 2.66			
0.13–0.16	0.145	44.9	33.80 ± 1.61 ± 2.22	0.145	55.1	33.05 ± 1.67 ± 2.23
0.16–0.20	0.180	44.8	35.95 ± 1.40 ± 2.02	0.180	54.9	25.51 ± 1.18 ± 1.43
0.20–0.24	0.219	44.7	29.67 ± 1.22 ± 1.51	0.220	55.0	24.81 ± 1.14 ± 1.27
0.24–0.30	0.270	44.6	29.08 ± 1.01 ± 1.27	0.268	54.9	22.05 ± 0.86 ± 0.98
0.30–0.36	0.328	44.7	21.38 ± 0.84 ± 0.89	0.328	54.6	18.50 ± 0.80 ± 0.79
0.36–0.42	0.389	44.6	17.15 ± 0.77 ± 0.73	0.387	54.5	13.94 ± 0.70 ± 0.63
0.42–0.50	0.458	44.8	11.56 ± 0.55 ± 0.56	0.458	54.7	8.64 ± 0.47 ± 0.45
0.50–0.60	0.545	44.8	6.56 ± 0.36 ± 0.40	0.547	54.7	4.91 ± 0.31 ± 0.33
0.60–0.72	0.653	44.4	3.30 ± 0.23 ± 0.27	0.652	54.5	2.52 ± 0.21 ± 0.22
0.72–0.90	0.789	44.6	1.27 ± 0.12 ± 0.14	0.794	54.7	0.86 ± 0.10 ± 0.10
0.90–1.25				1.016	54.3	0.23 ± 0.03 ± 0.04

	$60 < \theta < 75$			$75 < \theta < 90$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.13–0.16	0.146	67.3	26.18 ± 1.20 ± 1.68	0.145	82.3	22.89 ± 1.12 ± 1.53
0.16–0.20	0.179	67.0	27.14 ± 1.00 ± 1.42	0.178	82.3	21.90 ± 0.90 ± 1.14
0.20–0.24	0.219	67.4	21.45 ± 0.87 ± 1.02	0.219	82.0	19.70 ± 0.85 ± 0.92
0.24–0.30	0.267	67.0	16.93 ± 0.62 ± 0.71	0.267	82.2	12.55 ± 0.55 ± 0.54
0.30–0.36	0.328	66.9	13.26 ± 0.57 ± 0.59	0.327	81.8	8.22 ± 0.43 ± 0.40
0.36–0.42	0.386	66.8	8.35 ± 0.43 ± 0.40	0.388	82.2	5.50 ± 0.36 ± 0.32
0.42–0.50	0.457	66.8	6.07 ± 0.32 ± 0.34	0.454	81.8	2.98 ± 0.22 ± 0.21
0.50–0.60	0.541	66.7	3.32 ± 0.21 ± 0.24	0.543	82.5	1.56 ± 0.15 ± 0.14
0.60–0.72	0.649	66.7	1.51 ± 0.13 ± 0.14	0.651	80.9	0.72 ± 0.09 ± 0.08
0.72–0.90	0.781	67.4	0.59 ± 0.07 ± 0.07	0.781	81.1	0.27 ± 0.04 ± 0.05
0.90–1.25	0.991	66.5	0.09 ± 0.02 ± 0.02			

	$90 < \theta < 105$			$105 < \theta < 125$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.13–0.16	0.145	97.1	22.17 ± 1.11 ± 1.47	0.145	114.7	19.47 ± 0.90 ± 1.13
0.16–0.20	0.179	97.2	20.40 ± 0.90 ± 1.05	0.178	114.1	14.42 ± 0.63 ± 0.69
0.20–0.24	0.218	97.2	13.25 ± 0.69 ± 0.65	0.217	113.9	8.50 ± 0.48 ± 0.45
0.24–0.30	0.267	96.7	8.69 ± 0.45 ± 0.44	0.266	112.8	4.57 ± 0.28 ± 0.28
0.30–0.36	0.326	97.2	5.04 ± 0.34 ± 0.31	0.327	113.5	2.31 ± 0.20 ± 0.19
0.36–0.42	0.387	96.6	3.56 ± 0.29 ± 0.28	0.386	112.9	1.16 ± 0.15 ± 0.12
0.42–0.50	0.451	96.4	1.64 ± 0.17 ± 0.16	0.451	112.3	0.75 ± 0.10 ± 0.10
0.50–0.60	0.548	97.0	0.96 ± 0.12 ± 0.12	0.536	115.4	0.14 ± 0.03 ± 0.03
0.60–0.72	0.657	96.2	0.27 ± 0.05 ± 0.05			
0.72–0.90	0.805	98.9	0.02 ± 0.01 ± 0.01			

Table A.13: Double-differential inclusive cross-section $\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$ [mb/(GeV/c sr)] of the production of protons in π^+ + C $\rightarrow$ p + X interactions with $+5.0$ GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees.

	$20 < \theta < 30$					$30 < \theta < 40$				
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$			$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$		
0.20–0.24	0.220	25.0	61.58	$\pm$ 1.61	$\pm$ 3.45					
0.24–0.30	0.270	25.0	58.04	$\pm$ 1.29	$\pm$ 3.09	0.270	35.0	56.52	$\pm$ 1.21	$\pm$ 2.76
0.30–0.36	0.329	25.0	50.08	$\pm$ 1.19	$\pm$ 2.59	0.329	35.1	54.56	$\pm$ 1.21	$\pm$ 2.46
0.36–0.42	0.389	25.1	47.24	$\pm$ 1.17	$\pm$ 2.42	0.389	35.0	44.23	$\pm$ 1.14	$\pm$ 2.27
0.42–0.50	0.459	25.0	40.81	$\pm$ 0.90	$\pm$ 1.96	0.459	35.0	37.34	$\pm$ 0.90	$\pm$ 1.95
0.50–0.60	0.547	24.9	33.56	$\pm$ 0.72	$\pm$ 1.75	0.548	35.0	30.26	$\pm$ 0.73	$\pm$ 1.68
0.60–0.72	0.655	25.0	25.75	$\pm$ 0.56	$\pm$ 1.55	0.655	34.9	22.45	$\pm$ 0.56	$\pm$ 1.34
0.72–0.90						0.800	35.0	15.02	$\pm$ 0.37	$\pm$ 1.09

	$40 < \theta < 50$					$50 < \theta < 60$				
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$			$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$		
0.30–0.36	0.330	45.1	54.47	$\pm$ 1.17	$\pm$ 2.28					
0.36–0.42	0.389	45.0	45.96	$\pm$ 1.09	$\pm$ 1.85	0.390	55.0	45.58	$\pm$ 1.06	$\pm$ 1.80
0.42–0.50	0.458	44.9	35.36	$\pm$ 0.88	$\pm$ 1.65	0.458	55.1	36.55	$\pm$ 0.85	$\pm$ 1.46
0.50–0.60	0.548	45.1	27.55	$\pm$ 0.71	$\pm$ 1.58	0.546	55.0	27.06	$\pm$ 0.70	$\pm$ 1.49
0.60–0.72	0.654	45.1	19.65	$\pm$ 0.55	$\pm$ 1.20	0.654	55.0	17.13	$\pm$ 0.52	$\pm$ 1.15
0.72–0.90	0.798	45.0	12.01	$\pm$ 0.36	$\pm$ 0.91	0.796	55.0	9.00	$\pm$ 0.32	$\pm$ 0.78
0.90–1.25	1.036	44.9	4.15	$\pm$ 0.15	$\pm$ 0.43	1.036	54.9	2.43	$\pm$ 0.12	$\pm$ 0.34

	$60 < \theta < 75$					$75 < \theta < 90$				
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$			$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$		
0.42–0.50	0.461	67.3	35.14	$\pm$ 0.67	$\pm$ 1.29	0.460	81.9	28.79	$\pm$ 0.61	$\pm$ 1.22
0.50–0.60	0.550	67.1	25.04	$\pm$ 0.55	$\pm$ 1.25	0.549	81.8	17.50	$\pm$ 0.44	$\pm$ 0.96
0.60–0.72	0.658	67.1	12.68	$\pm$ 0.38	$\pm$ 1.12	0.657	81.8	6.67	$\pm$ 0.29	$\pm$ 0.86
0.72–0.90	0.800	67.0	5.35	$\pm$ 0.22	$\pm$ 0.73					

	$90 < \theta < 105$					$105 < \theta < 125$				
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$			$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$		
0.42–0.50	0.459	97.0	18.60	$\pm$ 0.48	$\pm$ 1.08	0.458	113.2	8.72	$\pm$ 0.29	$\pm$ 0.51
0.50–0.60	0.547	96.8	9.92	$\pm$ 0.33	$\pm$ 0.70	0.546	113.2	3.43	$\pm$ 0.19	$\pm$ 0.42

Table A.14: Double-differential inclusive cross-section $\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$ [mb/(GeV/c sr)] of the production of π^+'s in π^+ + C $\to$ π^+ + X interactions with $+5.0$ GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees.

	$20 < \theta < 30$			$30 < \theta < 40$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.10–0.13	0.116	25.0	59.10 ± 2.09 ± 4.21	0.115	34.9	54.08 ± 2.08 ± 4.22
0.13–0.16	0.145	24.8	71.32 ± 2.10 ± 4.21	0.146	34.8	61.43 ± 1.98 ± 3.69
0.16–0.20	0.180	24.8	87.35 ± 1.97 ± 4.53	0.180	34.8	68.15 ± 1.74 ± 3.53
0.20–0.24	0.220	24.8	98.57 ± 2.03 ± 4.56	0.220	34.7	71.36 ± 1.72 ± 3.30
0.24–0.30	0.270	24.8	94.42 ± 1.62 ± 3.89	0.270	34.8	67.45 ± 1.36 ± 2.76
0.30–0.36	0.329	24.7	82.75 ± 1.50 ± 3.22	0.329	34.8	61.40 ± 1.29 ± 2.33
0.36–0.42	0.389	24.8	69.10 ± 1.36 ± 2.85	0.389	34.7	49.73 ± 1.14 ± 1.88
0.42–0.50	0.458	24.8	56.77 ± 1.08 ± 3.12	0.459	34.8	43.95 ± 0.96 ± 1.96
0.50–0.60	0.546	24.8	35.37 ± 0.72 ± 2.79	0.546	34.7	27.72 ± 0.65 ± 1.73
0.60–0.72	0.655	24.8	22.50 ± 0.51 ± 2.74	0.655	34.6	15.60 ± 0.42 ± 1.54
0.72–0.90				0.796	34.8	8.15 ± 0.24 ± 1.38

	$40 < \theta < 50$			$50 < \theta < 60$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.10–0.13	0.116	44.9	44.13 ± 1.91 ± 3.54			
0.13–0.16	0.146	44.9	50.48 ± 1.76 ± 3.07	0.145	54.7	42.48 ± 1.66 ± 2.68
0.16–0.20	0.180	44.8	54.01 ± 1.54 ± 2.84	0.180	54.8	45.26 ± 1.42 ± 2.37
0.20–0.24	0.220	44.7	55.33 ± 1.53 ± 2.60	0.220	54.6	42.12 ± 1.33 ± 1.99
0.24–0.30	0.269	44.7	51.58 ± 1.20 ± 2.12	0.269	54.9	39.63 ± 1.05 ± 1.63
0.30–0.36	0.329	44.7	45.37 ± 1.10 ± 1.73	0.329	54.7	32.22 ± 0.95 ± 1.24
0.36–0.42	0.389	44.8	40.33 ± 1.07 ± 1.57	0.389	54.7	28.20 ± 0.90 ± 1.15
0.42–0.50	0.457	44.8	30.97 ± 0.81 ± 1.29	0.458	54.6	19.75 ± 0.63 ± 0.87
0.50–0.60	0.546	44.5	19.76 ± 0.56 ± 1.05	0.547	54.5	13.03 ± 0.45 ± 0.71
0.60–0.72	0.653	44.5	11.29 ± 0.37 ± 0.87	0.653	54.7	7.74 ± 0.32 ± 0.58
0.72–0.90	0.796	44.6	5.48 ± 0.21 ± 0.71	0.799	54.3	3.90 ± 0.18 ± 0.44
0.90–1.25				1.022	54.4	1.04 ± 0.06 ± 0.20

	$60 < \theta < 75$			$75 < \theta < 90$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.13–0.16	0.146	67.5	35.43 ± 1.25 ± 2.26	0.146	82.5	27.46 ± 1.11 ± 1.79
0.16–0.20	0.180	67.4	36.26 ± 1.03 ± 1.89	0.180	81.9	31.57 ± 0.99 ± 1.63
0.20–0.24	0.220	66.9	33.81 ± 1.00 ± 1.55	0.220	82.5	27.64 ± 0.91 ± 1.27
0.24–0.30	0.269	67.0	28.33 ± 0.73 ± 1.13	0.268	82.1	19.96 ± 0.62 ± 0.81
0.30–0.36	0.330	66.8	23.71 ± 0.68 ± 0.94	0.330	82.1	13.69 ± 0.51 ± 0.58
0.36–0.42	0.389	66.8	17.40 ± 0.57 ± 0.72	0.390	82.0	11.02 ± 0.45 ± 0.54
0.42–0.50	0.460	66.7	12.34 ± 0.41 ± 0.59	0.457	81.8	7.52 ± 0.32 ± 0.44
0.50–0.60	0.550	66.8	8.50 ± 0.30 ± 0.52	0.548	81.7	4.66 ± 0.23 ± 0.34
0.60–0.72	0.655	66.4	4.88 ± 0.21 ± 0.40	0.658	81.1	2.57 ± 0.16 ± 0.25
0.72–0.90	0.804	65.7	2.13 ± 0.11 ± 0.26	0.798	81.1	0.84 ± 0.07 ± 0.12
0.90–1.25	1.023	65.9	0.40 ± 0.03 ± 0.08	1.033	81.2	0.08 ± 0.01 ± 0.02

	$90 < \theta < 105$			$105 < \theta < 125$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.13–0.16	0.145	97.5	28.52 ± 1.14 ± 1.81	0.145	114.5	24.12 ± 0.90 ± 1.36
0.16–0.20	0.180	97.2	27.97 ± 0.93 ± 1.37	0.179	114.0	19.93 ± 0.68 ± 0.89
0.20–0.24	0.219	96.9	22.02 ± 0.80 ± 0.96	0.219	114.2	13.00 ± 0.54 ± 0.58
0.24–0.30	0.268	96.8	13.31 ± 0.51 ± 0.56	0.267	114.1	8.25 ± 0.34 ± 0.41
0.30–0.36	0.330	96.9	9.30 ± 0.42 ± 0.47	0.329	113.2	4.88 ± 0.26 ± 0.31
0.36–0.42	0.391	96.7	6.25 ± 0.34 ± 0.39	0.388	113.4	3.54 ± 0.23 ± 0.28
0.42–0.50	0.459	96.7	3.95 ± 0.24 ± 0.30	0.459	112.9	1.80 ± 0.14 ± 0.18
0.50–0.60	0.544	96.2	2.50 ± 0.17 ± 0.25	0.546	112.0	0.62 ± 0.07 ± 0.09
0.60–0.72	0.658	95.9	0.86 ± 0.08 ± 0.12	0.654	114.7	0.15 ± 0.03 ± 0.03
0.72–0.90	0.793	95.3	0.17 ± 0.03 ± 0.04	0.810	110.7	0.03 ± 0.01 ± 0.01
0.90–1.25	1.053	96.1	0.03 ± 0.01 ± 0.01			

Table A.15: Double-differential inclusive cross-section $\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$ [mb/(GeV/c sr)] of the production of π^-'s in π^+ + C $\to \pi^-$ + X interactions with $+5.0$ GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees.

	$20 < \theta < 30$			$30 < \theta < 40$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.10–0.13	0.116	24.9	48.31 ± 1.83 ± 3.57	0.116	34.8	41.09 ± 1.70 ± 3.20
0.13–0.16	0.146	24.8	57.80 ± 1.87 ± 3.54	0.145	34.9	46.08 ± 1.70 ± 2.96
0.16–0.20	0.181	24.7	63.95 ± 1.61 ± 3.37	0.180	34.9	46.94 ± 1.40 ± 2.53
0.20–0.24	0.220	24.8	63.38 ± 1.60 ± 2.96	0.220	34.8	49.49 ± 1.42 ± 2.36
0.24–0.30	0.270	24.7	60.54 ± 1.27 ± 2.46	0.270	34.8	40.95 ± 1.02 ± 1.70
0.30–0.36	0.329	24.7	49.28 ± 1.14 ± 1.87	0.329	34.8	40.10 ± 1.03 ± 1.55
0.36–0.42	0.389	24.9	38.12 ± 1.00 ± 1.46	0.389	34.7	28.29 ± 0.86 ± 1.11
0.42–0.50	0.458	25.0	32.80 ± 0.84 ± 1.52	0.457	34.8	23.60 ± 0.71 ± 1.07
0.50–0.60	0.546	24.8	17.21 ± 0.52 ± 0.93	0.545	34.7	13.38 ± 0.45 ± 0.72
0.60–0.72	0.652	25.1	8.54 ± 0.33 ± 0.61	0.654	34.6	7.57 ± 0.31 ± 0.53
0.72–0.90				0.798	34.6	3.18 ± 0.17 ± 0.30

	$40 < \theta < 50$			$50 < \theta < 60$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.10–0.13	0.115	44.7	35.17 ± 1.67 ± 2.87			
0.13–0.16	0.145	44.8	36.88 ± 1.50 ± 2.36	0.146	55.1	31.08 ± 1.44 ± 2.06
0.16–0.20	0.180	44.8	37.00 ± 1.26 ± 2.02	0.179	54.9	29.96 ± 1.14 ± 1.64
0.20–0.24	0.220	44.8	33.17 ± 1.15 ± 1.63	0.219	54.8	28.05 ± 1.08 ± 1.38
0.24–0.30	0.269	44.8	34.57 ± 0.98 ± 1.47	0.270	54.7	25.20 ± 0.82 ± 1.07
0.30–0.36	0.328	44.8	26.66 ± 0.84 ± 1.05	0.329	54.8	21.86 ± 0.78 ± 0.89
0.36–0.42	0.389	44.9	23.04 ± 0.80 ± 0.93	0.389	54.7	16.67 ± 0.68 ± 0.71
0.42–0.50	0.457	44.7	17.07 ± 0.60 ± 0.77	0.457	54.8	11.59 ± 0.49 ± 0.56
0.50–0.60	0.546	44.6	9.67 ± 0.39 ± 0.55	0.543	54.6	7.43 ± 0.34 ± 0.45
0.60–0.72	0.655	44.8	5.72 ± 0.28 ± 0.43	0.657	54.3	3.56 ± 0.22 ± 0.28
0.72–0.90	0.792	44.5	2.67 ± 0.16 ± 0.27	0.793	54.8	2.16 ± 0.15 ± 0.23
0.90–1.25				1.011	54.3	0.42 ± 0.04 ± 0.06

	$60 < \theta < 75$			$75 < \theta < 90$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.13–0.16	0.145	67.3	24.63 ± 1.04 ± 1.57	0.145	82.3	19.53 ± 0.92 ± 1.28
0.16–0.20	0.179	67.1	25.17 ± 0.86 ± 1.31	0.179	82.1	20.69 ± 0.78 ± 1.07
0.20–0.24	0.219	66.9	23.01 ± 0.81 ± 1.07	0.218	82.2	17.09 ± 0.70 ± 0.79
0.24–0.30	0.268	66.8	17.29 ± 0.56 ± 0.71	0.268	81.9	12.84 ± 0.49 ± 0.54
0.30–0.36	0.328	66.8	14.67 ± 0.53 ± 0.63	0.327	82.2	8.83 ± 0.40 ± 0.41
0.36–0.42	0.387	66.9	10.98 ± 0.44 ± 0.49	0.387	82.0	6.96 ± 0.36 ± 0.38
0.42–0.50	0.456	66.9	7.62 ± 0.32 ± 0.40	0.455	81.8	4.37 ± 0.24 ± 0.28
0.50–0.60	0.544	66.6	4.91 ± 0.23 ± 0.32	0.540	81.8	2.86 ± 0.18 ± 0.23
0.60–0.72	0.643	66.5	2.53 ± 0.15 ± 0.22	0.645	80.8	1.26 ± 0.11 ± 0.14
0.72–0.90	0.791	66.4	1.04 ± 0.08 ± 0.12	0.795	81.3	0.40 ± 0.05 ± 0.06
0.90–1.25	1.000	67.7	0.16 ± 0.02 ± 0.03	1.010	80.3	0.03 ± 0.01 ± 0.01

	$90 < \theta < 105$			$105 < \theta < 125$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.13–0.16	0.146	97.6	21.19 ± 0.97 ± 1.40	0.145	114.5	17.83 ± 0.77 ± 1.04
0.16–0.20	0.180	97.3	18.75 ± 0.77 ± 0.96	0.178	114.5	13.13 ± 0.55 ± 0.62
0.20–0.24	0.218	97.2	14.17 ± 0.64 ± 0.65	0.218	113.0	8.56 ± 0.43 ± 0.42
0.24–0.30	0.268	97.1	9.60 ± 0.42 ± 0.44	0.265	113.6	5.93 ± 0.29 ± 0.33
0.30–0.36	0.327	97.1	5.83 ± 0.33 ± 0.33	0.325	114.3	2.74 ± 0.20 ± 0.20
0.36–0.42	0.386	97.0	4.15 ± 0.28 ± 0.29	0.387	113.8	2.19 ± 0.18 ± 0.21
0.42–0.50	0.452	96.3	2.55 ± 0.19 ± 0.22	0.451	113.4	1.28 ± 0.12 ± 0.15
0.50–0.60	0.541	96.4	1.51 ± 0.13 ± 0.17	0.540	111.8	0.31 ± 0.05 ± 0.05
0.60–0.72	0.650	96.5	0.45 ± 0.06 ± 0.07	0.648	109.7	0.08 ± 0.02 ± 0.02
0.72–0.90	0.767	97.3	0.09 ± 0.02 ± 0.03	0.853	108.2	0.02 ± 0.01 ± 0.01

Table A.16: Double-differential inclusive cross-section $\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$ [mb/(GeV/c sr)] of the production of protons in π^- + C $\to$ p + X interactions with -5.0 GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees.

	$20 < \theta < 30$			$30 < \theta < 40$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.20–0.24	0.221	25.0	46.65 ± 1.47 ± 2.65			
0.24–0.30	0.270	25.0	47.23 ± 1.24 ± 2.59	0.271	35.0	47.99 ± 1.17 ± 2.33
0.30–0.36	0.330	25.0	39.82 ± 1.13 ± 2.20	0.331	35.0	43.33 ± 1.13 ± 2.02
0.36–0.42	0.391	25.1	38.33 ± 1.12 ± 2.03	0.391	35.1	35.93 ± 1.08 ± 1.87
0.42–0.50	0.461	25.0	32.11 ± 0.85 ± 1.62	0.461	34.9	29.25 ± 0.85 ± 1.62
0.50–0.60	0.551	25.0	26.83 ± 0.70 ± 1.43	0.550	34.9	24.21 ± 0.69 ± 1.37
0.60–0.72	0.660	25.1	19.52 ± 0.52 ± 1.21	0.660	34.9	16.49 ± 0.52 ± 1.05
0.72–0.90				0.805	34.9	10.55 ± 0.34 ± 0.81

	$40 < \theta < 50$			$50 < \theta < 60$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.30–0.36	0.329	45.1	42.84 ± 1.09 ± 1.76			
0.36–0.42	0.390	44.9	36.80 ± 1.03 ± 1.51	0.389	54.9	36.48 ± 0.99 ± 1.43
0.42–0.50	0.458	45.0	28.69 ± 0.83 ± 1.44	0.458	55.0	28.86 ± 0.80 ± 1.19
0.50–0.60	0.548	45.1	19.92 ± 0.63 ± 1.23	0.547	55.0	20.26 ± 0.64 ± 1.16
0.60–0.72	0.656	45.0	15.10 ± 0.53 ± 1.05	0.658	55.1	12.73 ± 0.47 ± 0.93
0.72–0.90	0.801	44.9	8.41 ± 0.32 ± 0.71	0.797	54.8	7.04 ± 0.30 ± 0.66
0.90–1.25	1.034	44.8	2.55 ± 0.12 ± 0.29	1.026	54.6	1.78 ± 0.11 ± 0.25

	$60 < \theta < 75$			$75 < \theta < 90$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.42–0.50	0.458	67.3	29.57 ± 0.64 ± 1.10	0.458	82.0	22.38 ± 0.55 ± 1.00
0.50–0.60	0.545	67.3	18.19 ± 0.48 ± 0.96	0.546	82.0	14.75 ± 0.42 ± 0.82
0.60–0.72	0.655	67.1	9.92 ± 0.37 ± 1.03			

	$90 < \theta < 105$			$105 < \theta < 125$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.42–0.50	0.457	96.9	14.39 ± 0.44 ± 0.84	0.456	113.6	7.68 ± 0.28 ± 0.45
0.50–0.60	0.546	96.8	7.97 ± 0.30 ± 0.58	0.545	113.1	2.81 ± 0.17 ± 0.34

Table A.17: Double-differential inclusive cross-section $\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$ [mb/(GeV/c sr)] of the production of π^+'s in π^- + C $\to \pi^+$ + X interactions with -5.0 GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees.

	$20 < \theta < 30$			$30 < \theta < 40$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.10–0.13	0.115	24.9	44.58 ± 1.87 ± 3.29	0.116	35.0	41.43 ± 1.85 ± 3.26
0.13–0.16	0.146	24.7	55.25 ± 1.91 ± 3.30	0.145	34.8	43.88 ± 1.67 ± 2.69
0.16–0.20	0.181	24.8	64.72 ± 1.71 ± 3.36	0.180	34.6	52.85 ± 1.58 ± 2.78
0.20–0.24	0.220	24.7	66.54 ± 1.71 ± 3.11	0.221	34.7	51.21 ± 1.48 ± 2.40
0.24–0.30	0.270	24.7	68.71 ± 1.40 ± 2.85	0.270	34.6	47.25 ± 1.17 ± 1.96
0.30–0.36	0.330	24.7	57.90 ± 1.30 ± 2.28	0.331	34.7	41.78 ± 1.10 ± 1.62
0.36–0.42	0.390	24.8	46.75 ± 1.16 ± 1.95	0.391	34.6	34.01 ± 0.98 ± 1.32
0.42–0.50	0.460	24.7	35.35 ± 0.89 ± 1.99	0.460	34.7	25.86 ± 0.77 ± 1.22
0.50–0.60	0.548	24.9	21.97 ± 0.59 ± 1.74	0.548	34.8	16.32 ± 0.51 ± 1.04
0.60–0.72	0.656	24.8	11.80 ± 0.37 ± 1.44	0.659	34.7	8.97 ± 0.34 ± 0.89
0.72–0.90				0.802	34.5	4.10 ± 0.17 ± 0.70

	$40 < \theta < 50$			$50 < \theta < 60$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.10–0.13	0.115	44.9	31.46 ± 1.63 ± 2.50			
0.13–0.16	0.146	44.9	33.57 ± 1.53 ± 2.10	0.146	55.2	30.95 ± 1.48 ± 2.00
0.16–0.20	0.181	44.8	40.17 ± 1.37 ± 2.14	0.180	54.7	34.27 ± 1.27 ± 1.83
0.20–0.24	0.220	44.9	37.60 ± 1.29 ± 1.80	0.220	54.9	28.37 ± 1.11 ± 1.37
0.24–0.30	0.270	44.8	35.99 ± 1.03 ± 1.51	0.269	54.8	26.98 ± 0.89 ± 1.14
0.30–0.36	0.329	44.8	30.63 ± 0.94 ± 1.20	0.328	54.7	22.31 ± 0.82 ± 0.89
0.36–0.42	0.389	44.6	25.52 ± 0.88 ± 1.02	0.388	54.5	19.18 ± 0.77 ± 0.82
0.42–0.50	0.457	44.8	19.44 ± 0.67 ± 0.86	0.457	54.6	13.81 ± 0.56 ± 0.62
0.50–0.60	0.547	44.5	13.19 ± 0.48 ± 0.72	0.547	54.7	8.86 ± 0.39 ± 0.50
0.60–0.72	0.656	44.7	6.78 ± 0.30 ± 0.53	0.656	54.8	5.25 ± 0.27 ± 0.40
0.72–0.90	0.793	44.4	2.98 ± 0.16 ± 0.39	0.793	54.7	2.08 ± 0.13 ± 0.24
0.90–1.25				1.023	54.0	0.46 ± 0.04 ± 0.09

	$60 < \theta < 75$			$75 < \theta < 90$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.13–0.16	0.145	67.0	23.24 ± 1.03 ± 1.50	0.145	82.7	19.53 ± 0.97 ± 1.31
0.16–0.20	0.179	67.2	26.37 ± 0.91 ± 1.39	0.180	82.1	20.71 ± 0.82 ± 1.10
0.20–0.24	0.219	67.4	22.86 ± 0.83 ± 1.08	0.219	82.0	18.17 ± 0.75 ± 0.85
0.24–0.30	0.269	67.2	20.43 ± 0.64 ± 0.84	0.269	82.0	12.99 ± 0.51 ± 0.55
0.30–0.36	0.329	67.0	15.81 ± 0.56 ± 0.62	0.329	82.0	9.42 ± 0.43 ± 0.41
0.36–0.42	0.389	66.8	11.51 ± 0.47 ± 0.49	0.389	81.9	7.23 ± 0.37 ± 0.36
0.42–0.50	0.457	66.5	9.00 ± 0.36 ± 0.44	0.455	81.7	5.26 ± 0.28 ± 0.31
0.50–0.60	0.546	66.9	5.73 ± 0.26 ± 0.36	0.544	81.6	3.36 ± 0.20 ± 0.25
0.60–0.72	0.652	66.6	3.32 ± 0.18 ± 0.28	0.655	81.4	1.46 ± 0.12 ± 0.15
0.72–0.90	0.795	66.5	1.04 ± 0.07 ± 0.13	0.796	81.3	0.42 ± 0.05 ± 0.06
0.90–1.25	1.023	65.9	0.17 ± 0.02 ± 0.04	1.028	81.0	0.03 ± 0.01 ± 0.01

	$90 < \theta < 105$			$105 < \theta < 125$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.13–0.16	0.145	97.3	16.86 ± 0.89 ± 1.10	0.144	114.8	16.84 ± 0.79 ± 0.99
0.16–0.20	0.180	97.6	17.95 ± 0.77 ± 0.91	0.179	114.3	13.27 ± 0.58 ± 0.62
0.20–0.24	0.219	96.8	15.36 ± 0.70 ± 0.69	0.219	113.9	9.25 ± 0.47 ± 0.43
0.24–0.30	0.269	97.1	10.24 ± 0.46 ± 0.45	0.267	113.3	5.98 ± 0.30 ± 0.31
0.30–0.36	0.330	96.6	6.37 ± 0.36 ± 0.33	0.327	113.6	3.69 ± 0.24 ± 0.24
0.36–0.42	0.389	96.9	4.18 ± 0.29 ± 0.27	0.386	113.1	2.26 ± 0.18 ± 0.19
0.42–0.50	0.459	96.4	2.78 ± 0.20 ± 0.22	0.457	113.1	1.25 ± 0.12 ± 0.13
0.50–0.60	0.543	96.8	1.50 ± 0.14 ± 0.16	0.540	112.8	0.53 ± 0.06 ± 0.08
0.60–0.72	0.654	96.1	0.57 ± 0.07 ± 0.08	0.656	111.0	0.09 ± 0.02 ± 0.02
0.72–0.90	0.777	94.5	0.09 ± 0.02 ± 0.02	0.765	112.9	0.03 ± 0.01 ± 0.01

Table A.18: Double-differential inclusive cross-section $\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$ [mb/(GeV/c sr)] of the production of π^-'s in π^- + C $\to$ π^- + X interactions with -5.0 GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees.

	$20 < \theta < 30$			$30 < \theta < 40$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.10–0.13	0.116	24.7	79.37 ± 2.53 ± 5.82	0.115	34.8	65.20 ± 2.32 ± 4.97
0.13–0.16	0.145	24.8	92.14 ± 2.50 ± 5.50	0.145	34.8	74.34 ± 2.28 ± 4.58
0.16–0.20	0.180	24.8	105.52 ± 2.22 ± 5.41	0.180	34.8	78.17 ± 1.91 ± 4.06
0.20–0.24	0.219	24.9	108.37 ± 2.22 ± 4.90	0.219	34.6	82.80 ± 1.93 ± 3.79
0.24–0.30	0.268	24.9	101.74 ± 1.73 ± 4.02	0.268	34.7	73.64 ± 1.48 ± 2.94
0.30–0.36	0.328	24.7	89.10 ± 1.62 ± 3.24	0.328	34.7	65.15 ± 1.37 ± 2.40
0.36–0.42	0.388	24.8	72.71 ± 1.47 ± 2.67	0.388	34.8	55.69 ± 1.27 ± 2.07
0.42–0.50	0.455	24.8	58.97 ± 1.18 ± 2.64	0.456	34.8	42.73 ± 0.97 ± 1.75
0.50–0.60	0.543	24.9	38.16 ± 0.80 ± 1.98	0.543	34.7	29.54 ± 0.72 ± 1.51
0.60–0.72	0.652	25.0	23.68 ± 0.58 ± 1.62	0.651	34.8	17.27 ± 0.49 ± 1.16
0.72–0.90				0.791	34.7	8.27 ± 0.28 ± 0.75

	$40 < \theta < 50$			$50 < \theta < 60$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.10–0.13	0.116	44.9	54.58 ± 2.20 ± 4.39			
0.13–0.16	0.145	44.8	57.19 ± 2.00 ± 3.53	0.145	54.9	48.98 ± 1.88 ± 3.13
0.16–0.20	0.180	45.0	58.54 ± 1.68 ± 3.09	0.180	54.9	51.21 ± 1.57 ± 2.71
0.20–0.24	0.220	44.8	59.15 ± 1.64 ± 2.76	0.220	55.0	44.51 ± 1.44 ± 2.08
0.24–0.30	0.270	44.7	54.23 ± 1.26 ± 2.19	0.269	54.8	43.45 ± 1.15 ± 1.76
0.30–0.36	0.329	44.6	48.06 ± 1.19 ± 1.79	0.328	54.8	35.44 ± 1.03 ± 1.34
0.36–0.42	0.389	44.6	41.59 ± 1.12 ± 1.57	0.389	54.7	29.67 ± 0.96 ± 1.18
0.42–0.50	0.458	44.8	32.43 ± 0.87 ± 1.42	0.458	54.7	21.61 ± 0.70 ± 0.97
0.50–0.60	0.546	44.7	20.01 ± 0.58 ± 1.08	0.547	54.7	13.67 ± 0.48 ± 0.78
0.60–0.72	0.656	44.9	12.10 ± 0.41 ± 0.86	0.652	54.6	7.86 ± 0.33 ± 0.58
0.72–0.90	0.798	44.6	5.77 ± 0.24 ± 0.56	0.794	54.5	3.75 ± 0.20 ± 0.38
0.90–1.25				1.023	54.4	0.94 ± 0.07 ± 0.14

	$60 < \theta < 75$			$75 < \theta < 90$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.13–0.16	0.145	67.4	39.85 ± 1.39 ± 2.45	0.145	82.2	34.54 ± 1.31 ± 2.18
0.16–0.20	0.180	67.4	42.60 ± 1.17 ± 2.13	0.180	82.3	36.21 ± 1.11 ± 1.82
0.20–0.24	0.219	67.1	38.82 ± 1.11 ± 1.71	0.220	82.1	28.47 ± 0.95 ± 1.23
0.24–0.30	0.269	66.9	30.60 ± 0.79 ± 1.19	0.268	82.3	21.48 ± 0.67 ± 0.87
0.30–0.36	0.329	67.0	24.30 ± 0.70 ± 0.92	0.328	82.0	14.80 ± 0.54 ± 0.63
0.36–0.42	0.389	66.9	17.68 ± 0.59 ± 0.74	0.388	82.0	10.27 ± 0.45 ± 0.51
0.42–0.50	0.459	66.6	11.97 ± 0.42 ± 0.59	0.457	81.7	7.80 ± 0.34 ± 0.47
0.50–0.60	0.547	66.6	8.14 ± 0.31 ± 0.51	0.543	81.4	5.01 ± 0.25 ± 0.39
0.60–0.72	0.651	66.8	4.70 ± 0.22 ± 0.39	0.651	80.7	2.50 ± 0.17 ± 0.26
0.72–0.90	0.790	66.8	2.19 ± 0.13 ± 0.25	0.787	81.5	0.79 ± 0.07 ± 0.11
0.90–1.25	1.020	66.6	0.37 ± 0.03 ± 0.06	0.995	80.4	0.07 ± 0.02 ± 0.02

	$90 < \theta < 105$			$105 < \theta < 125$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.13–0.16	0.145	97.1	31.75 ± 1.27 ± 2.00	0.144	114.6	28.09 ± 1.04 ± 1.56
0.16–0.20	0.179	97.0	28.61 ± 0.98 ± 1.39	0.179	113.9	21.18 ± 0.72 ± 0.93
0.20–0.24	0.220	97.1	22.43 ± 0.86 ± 0.99	0.218	114.2	14.67 ± 0.59 ± 0.66
0.24–0.30	0.266	97.1	14.92 ± 0.55 ± 0.64	0.267	113.6	8.37 ± 0.36 ± 0.43
0.30–0.36	0.328	97.2	9.27 ± 0.43 ± 0.48	0.328	113.8	4.92 ± 0.27 ± 0.34
0.36–0.42	0.388	97.2	6.57 ± 0.36 ± 0.43	0.389	113.5	3.59 ± 0.24 ± 0.32
0.42–0.50	0.456	97.1	4.39 ± 0.26 ± 0.36	0.456	112.6	1.71 ± 0.14 ± 0.19
0.50–0.60	0.541	96.7	2.17 ± 0.17 ± 0.24	0.547	111.8	0.65 ± 0.08 ± 0.10
0.60–0.72	0.647	96.6	0.87 ± 0.09 ± 0.13	0.654	113.3	0.23 ± 0.04 ± 0.05
0.72–0.90	0.792	96.0	0.17 ± 0.03 ± 0.04			
0.90–1.25	1.000	96.6	0.02 ± 0.01 ± 0.01			

Table A.19: Double-differential inclusive cross-section $\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$ [mb/(GeV/c sr)] of the production of protons in p + C $\rightarrow$ p + X interactions with $+8.0$ GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees.

	$20 < \theta < 30$			$30 < \theta < 40$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.20–0.24	0.220	24.8	69.70 $\pm$ 1.83 $\pm$ 3.80			
0.24–0.30	0.270	25.0	68.40 $\pm$ 1.49 $\pm$ 3.47	0.270	34.9	67.75 $\pm$ 1.45 $\pm$ 3.17
0.30–0.36	0.330	25.0	63.66 $\pm$ 1.47 $\pm$ 3.16	0.330	34.9	61.87 $\pm$ 1.39 $\pm$ 2.65
0.36–0.42	0.389	24.9	58.48 $\pm$ 1.38 $\pm$ 2.72	0.389	35.0	53.52 $\pm$ 1.32 $\pm$ 2.44
0.42–0.50	0.458	25.0	52.22 $\pm$ 1.12 $\pm$ 2.28	0.459	34.9	45.93 $\pm$ 1.08 $\pm$ 2.07
0.50–0.60	0.548	24.9	45.90 $\pm$ 0.94 $\pm$ 1.97	0.548	34.9	39.32 $\pm$ 0.89 $\pm$ 1.79
0.60–0.72	0.657	24.9	35.25 $\pm$ 0.74 $\pm$ 1.65	0.656	34.9	29.22 $\pm$ 0.70 $\pm$ 1.52
0.72–0.90				0.800	34.9	19.52 $\pm$ 0.47 $\pm$ 1.22

	$40 < \theta < 50$			$50 < \theta < 60$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.30–0.36	0.329	45.0	62.67 $\pm$ 1.35 $\pm$ 2.48			
0.36–0.42	0.389	45.0	55.65 $\pm$ 1.31 $\pm$ 2.05	0.388	55.1	49.92 $\pm$ 1.19 $\pm$ 1.91
0.42–0.50	0.459	45.1	44.79 $\pm$ 1.07 $\pm$ 1.90	0.458	55.0	44.94 $\pm$ 1.02 $\pm$ 1.65
0.50–0.60	0.548	45.0	33.17 $\pm$ 0.83 $\pm$ 1.65	0.548	55.0	32.01 $\pm$ 0.81 $\pm$ 1.60
0.60–0.72	0.658	45.0	25.22 $\pm$ 0.68 $\pm$ 1.43	0.656	54.9	22.11 $\pm$ 0.64 $\pm$ 1.39
0.72–0.90	0.799	44.9	15.07 $\pm$ 0.43 $\pm$ 1.07	0.800	54.9	12.48 $\pm$ 0.41 $\pm$ 1.00
0.90–1.25	1.033	44.9	5.05 $\pm$ 0.18 $\pm$ 0.52	1.028	54.9	3.39 $\pm$ 0.15 $\pm$ 0.44

	$60 < \theta < 75$			$75 < \theta < 90$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.42–0.50	0.465	67.2	41.74 $\pm$ 0.79 $\pm$ 1.48	0.464	81.8	31.15 $\pm$ 0.67 $\pm$ 1.30
0.50–0.60	0.556	67.1	28.22 $\pm$ 0.62 $\pm$ 1.43	0.554	81.8	19.88 $\pm$ 0.50 $\pm$ 1.06
0.60–0.72	0.667	67.1	15.59 $\pm$ 0.46 $\pm$ 1.37	0.667	81.6	8.63 $\pm$ 0.35 $\pm$ 0.95
0.72–0.90	0.819	67.0	7.21 $\pm$ 0.27 $\pm$ 0.85	0.811	81.5	3.47 $\pm$ 0.19 $\pm$ 0.46

	$90 < \theta < 105$			$105 < \theta < 125$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.42–0.50	0.463	96.8	19.02 $\pm$ 0.53 $\pm$ 1.06	0.462	112.9	9.40 $\pm$ 0.33 $\pm$ 0.51
0.50–0.60	0.554	96.8	11.27 $\pm$ 0.38 $\pm$ 0.77	0.554	113.2	4.49 $\pm$ 0.23 $\pm$ 0.43
0.60–0.72	0.666	96.3	3.97 $\pm$ 0.25 $\pm$ 0.52	0.664	112.9	1.32 $\pm$ 0.12 $\pm$ 0.22
0.72–0.90	0.814	96.4	1.38 $\pm$ 0.12 $\pm$ 0.22	0.811	111.9	0.40 $\pm$ 0.06 $\pm$ 0.09

Table A.20: Double-differential inclusive cross-section $\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$ [mb/(GeV/c sr)] of the production of π^+'s in p + C $\to \pi^+$ + X interactions with $+8.0$ GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees.

	$20 < \theta < 30$			$30 < \theta < 40$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.10–0.13	0.116	24.7	67.33 ± 2.48 ± 4.90	0.116	34.8	47.81 ± 1.98 ± 3.51
0.13–0.16	0.145	24.6	88.97 ± 2.61 ± 5.17	0.145	34.7	61.56 ± 2.16 ± 3.61
0.16–0.20	0.180	24.5	100.88 ± 2.31 ± 5.09	0.180	34.8	68.63 ± 1.92 ± 3.47
0.20–0.24	0.220	24.7	104.16 ± 2.31 ± 4.70	0.220	34.6	68.98 ± 1.87 ± 3.10
0.24–0.30	0.269	24.7	91.13 ± 1.74 ± 3.65	0.269	34.7	66.94 ± 1.49 ± 2.65
0.30–0.36	0.329	24.8	79.00 ± 1.62 ± 2.92	0.330	34.7	53.00 ± 1.32 ± 1.94
0.36–0.42	0.389	24.8	62.85 ± 1.42 ± 2.33	0.389	34.8	42.43 ± 1.16 ± 1.54
0.42–0.50	0.457	24.8	45.22 ± 1.03 ± 1.88	0.459	34.7	32.42 ± 0.88 ± 1.27
0.50–0.60	0.546	24.8	29.67 ± 0.72 ± 1.61	0.546	34.6	21.57 ± 0.63 ± 1.07
0.60–0.72	0.653	24.8	17.29 ± 0.48 ± 1.34	0.654	34.7	12.37 ± 0.41 ± 0.86
0.72–0.90				0.796	34.7	5.87 ± 0.21 ± 0.63

	$40 < \theta < 50$			$50 < \theta < 60$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.10–0.13	0.116	44.9	35.55 ± 1.70 ± 2.69			
0.13–0.16	0.146	45.0	48.49 ± 1.89 ± 2.90	0.146	54.7	38.59 ± 1.68 ± 2.42
0.16–0.20	0.180	44.7	48.21 ± 1.59 ± 2.47	0.180	54.8	39.21 ± 1.41 ± 2.02
0.20–0.24	0.220	44.8	49.77 ± 1.59 ± 2.26	0.220	54.9	38.44 ± 1.41 ± 1.74
0.24–0.30	0.270	44.8	46.19 ± 1.23 ± 1.85	0.269	54.8	33.41 ± 1.06 ± 1.33
0.30–0.36	0.329	44.6	38.23 ± 1.12 ± 1.42	0.330	54.7	27.20 ± 0.95 ± 1.02
0.36–0.42	0.388	44.7	29.98 ± 0.99 ± 1.11	0.388	54.7	20.94 ± 0.81 ± 0.81
0.42–0.50	0.459	44.6	21.50 ± 0.70 ± 0.86	0.456	54.7	15.10 ± 0.60 ± 0.65
0.50–0.60	0.545	44.6	14.53 ± 0.52 ± 0.71	0.548	54.8	9.79 ± 0.43 ± 0.51
0.60–0.72	0.654	44.5	7.97 ± 0.34 ± 0.52	0.655	54.6	5.58 ± 0.30 ± 0.38
0.72–0.90	0.798	44.4	3.91 ± 0.18 ± 0.38	0.791	54.5	2.45 ± 0.15 ± 0.23
0.90–1.25				1.024	54.4	0.53 ± 0.04 ± 0.08

	$60 < \theta < 75$			$75 < \theta < 90$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.13–0.16	0.146	67.2	30.83 ± 1.19 ± 1.98	0.146	82.5	23.23 ± 1.01 ± 1.58
0.16–0.20	0.181	67.1	30.44 ± 0.97 ± 1.62	0.181	82.2	25.26 ± 0.88 ± 1.34
0.20–0.24	0.221	67.3	31.44 ± 1.02 ± 1.40	0.220	82.1	21.05 ± 0.80 ± 0.94
0.24–0.30	0.270	67.0	24.52 ± 0.74 ± 0.96	0.271	82.3	15.54 ± 0.58 ± 0.61
0.30–0.36	0.332	66.8	18.79 ± 0.64 ± 0.71	0.332	81.7	10.69 ± 0.47 ± 0.43
0.36–0.42	0.393	66.7	13.91 ± 0.54 ± 0.56	0.392	81.8	7.75 ± 0.41 ± 0.36
0.42–0.50	0.464	66.8	9.32 ± 0.38 ± 0.44	0.463	81.9	5.72 ± 0.30 ± 0.32
0.50–0.60	0.554	66.5	6.28 ± 0.28 ± 0.37	0.552	81.3	3.52 ± 0.21 ± 0.25
0.60–0.72	0.664	67.0	3.22 ± 0.18 ± 0.25	0.667	81.7	1.60 ± 0.13 ± 0.15
0.72–0.90	0.806	66.4	1.26 ± 0.09 ± 0.14	0.809	81.6	0.46 ± 0.05 ± 0.06
0.90–1.25	1.027	66.8	0.16 ± 0.02 ± 0.03	1.041	80.8	0.05 ± 0.01 ± 0.02

	$90 < \theta < 105$			$105 < \theta < 125$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.13–0.16	0.147	97.0	19.39 ± 0.91 ± 1.33	0.145	114.7	16.94 ± 0.72 ± 1.14
0.16–0.20	0.180	97.2	19.61 ± 0.76 ± 1.10	0.180	113.9	14.42 ± 0.56 ± 0.78
0.20–0.24	0.220	97.2	16.96 ± 0.72 ± 0.75	0.221	113.7	9.83 ± 0.48 ± 0.44
0.24–0.30	0.268	97.3	11.05 ± 0.49 ± 0.45	0.269	113.4	6.15 ± 0.32 ± 0.29
0.30–0.36	0.331	96.7	6.77 ± 0.38 ± 0.32	0.330	112.8	3.44 ± 0.24 ± 0.21
0.36–0.42	0.393	96.8	4.55 ± 0.31 ± 0.27	0.394	113.2	2.25 ± 0.19 ± 0.18
0.42–0.50	0.464	96.1	3.09 ± 0.22 ± 0.23	0.456	112.1	1.22 ± 0.13 ± 0.13
0.50–0.60	0.551	97.0	1.71 ± 0.15 ± 0.17	0.554	112.7	0.37 ± 0.06 ± 0.05
0.60–0.72	0.660	95.6	0.60 ± 0.08 ± 0.08	0.654	111.3	0.11 ± 0.03 ± 0.02
0.72–0.90	0.801	96.0	0.18 ± 0.03 ± 0.03			

Table A.21: Double-differential inclusive cross-section $\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$ [mb/(GeV/c sr)] of the production of π^-'s in p + C $\to \pi^-$ + X interactions with $+8.0$ GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees.

	$20 < \theta < 30$			$30 < \theta < 40$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.10–0.13	0.116	24.8	63.34 ± 2.33 ± 4.58	0.115	34.7	40.44 ± 1.75 ± 3.06
0.13–0.16	0.146	24.8	70.50 ± 2.25 ± 4.16	0.145	34.7	50.61 ± 1.86 ± 3.06
0.16–0.20	0.180	24.8	79.80 ± 2.01 ± 4.07	0.180	34.6	56.88 ± 1.69 ± 2.95
0.20–0.24	0.220	24.7	75.05 ± 1.92 ± 3.37	0.220	34.7	56.93 ± 1.66 ± 2.59
0.24–0.30	0.269	24.8	65.88 ± 1.47 ± 2.58	0.268	34.6	53.74 ± 1.31 ± 2.12
0.30–0.36	0.328	24.9	56.88 ± 1.37 ± 2.06	0.329	34.8	41.28 ± 1.15 ± 1.50
0.36–0.42	0.389	24.9	42.95 ± 1.18 ± 1.58	0.388	34.7	33.43 ± 1.02 ± 1.23
0.42–0.50	0.456	24.8	31.03 ± 0.87 ± 1.28	0.458	34.6	23.19 ± 0.73 ± 0.95
0.50–0.60	0.546	24.9	18.03 ± 0.58 ± 0.94	0.547	34.8	16.17 ± 0.55 ± 0.83
0.60–0.72	0.654	25.1	10.11 ± 0.41 ± 0.70	0.654	34.7	8.20 ± 0.35 ± 0.56
0.72–0.90				0.796	34.5	3.65 ± 0.18 ± 0.35

	$40 < \theta < 50$			$50 < \theta < 60$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.10–0.13	0.116	45.1	33.98 ± 1.61 ± 2.71			
0.13–0.16	0.146	45.0	42.34 ± 1.70 ± 2.63	0.146	54.8	31.01 ± 1.43 ± 2.05
0.16–0.20	0.180	44.6	47.37 ± 1.52 ± 2.49	0.179	54.9	35.65 ± 1.29 ± 1.93
0.20–0.24	0.220	44.6	43.94 ± 1.46 ± 2.03	0.219	54.9	35.08 ± 1.31 ± 1.61
0.24–0.30	0.269	44.7	38.77 ± 1.11 ± 1.55	0.270	54.9	28.69 ± 0.94 ± 1.15
0.30–0.36	0.330	44.7	30.58 ± 0.97 ± 1.13	0.328	54.7	21.67 ± 0.82 ± 0.82
0.36–0.42	0.389	44.7	23.90 ± 0.86 ± 0.91	0.389	54.7	17.48 ± 0.72 ± 0.70
0.42–0.50	0.458	44.5	17.09 ± 0.62 ± 0.74	0.456	54.7	11.97 ± 0.51 ± 0.56
0.50–0.60	0.548	44.7	10.39 ± 0.42 ± 0.58	0.545	54.8	6.58 ± 0.33 ± 0.41
0.60–0.72	0.653	44.8	6.43 ± 0.32 ± 0.47	0.655	54.5	3.88 ± 0.23 ± 0.30
0.72–0.90	0.795	44.4	2.09 ± 0.13 ± 0.23	0.792	54.5	1.33 ± 0.11 ± 0.14
0.90–1.25				1.018	54.8	0.22 ± 0.03 ± 0.04

	$60 < \theta < 75$			$75 < \theta < 90$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.13–0.16	0.144	67.2	24.57 ± 1.00 ± 1.74	0.145	82.5	19.89 ± 0.92 ± 1.38
0.16–0.20	0.179	67.4	26.57 ± 0.91 ± 1.37	0.178	82.0	20.16 ± 0.76 ± 1.20
0.20–0.24	0.218	67.6	25.57 ± 0.89 ± 1.11	0.218	82.4	19.07 ± 0.75 ± 0.88
0.24–0.30	0.266	66.9	20.45 ± 0.65 ± 0.79	0.265	82.0	13.64 ± 0.52 ± 0.53
0.30–0.36	0.325	67.0	15.79 ± 0.57 ± 0.60	0.326	82.0	8.74 ± 0.41 ± 0.40
0.36–0.42	0.384	66.9	10.25 ± 0.44 ± 0.48	0.384	81.6	6.30 ± 0.34 ± 0.35
0.42–0.50	0.452	66.9	8.38 ± 0.35 ± 0.42	0.450	81.4	3.90 ± 0.23 ± 0.25
0.50–0.60	0.535	66.6	4.53 ± 0.22 ± 0.31	0.532	80.9	2.29 ± 0.16 ± 0.19
0.60–0.72	0.642	66.8	2.42 ± 0.16 ± 0.20	0.641	81.7	0.87 ± 0.09 ± 0.09
0.72–0.90	0.772	66.8	0.78 ± 0.07 ± 0.09	0.783	81.2	0.34 ± 0.05 ± 0.05
0.90–1.25	1.003	65.6	0.16 ± 0.02 ± 0.03			

	$90 < \theta < 105$			$105 < \theta < 125$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.13–0.16	0.145	97.8	17.61 ± 0.84 ± 1.35	0.144	114.3	15.03 ± 0.64 ± 1.18
0.16–0.20	0.178	97.1	18.17 ± 0.73 ± 1.03	0.178	114.0	12.22 ± 0.49 ± 0.80
0.20–0.24	0.218	96.7	14.05 ± 0.64 ± 0.69	0.217	113.7	8.69 ± 0.43 ± 0.47
0.24–0.30	0.266	97.1	8.28 ± 0.39 ± 0.42	0.266	113.6	5.23 ± 0.27 ± 0.30
0.30–0.36	0.324	96.6	5.95 ± 0.33 ± 0.33	0.322	113.2	2.96 ± 0.21 ± 0.21
0.36–0.42	0.384	97.0	4.05 ± 0.28 ± 0.28	0.381	112.8	1.87 ± 0.17 ± 0.17
0.42–0.50	0.449	96.8	2.18 ± 0.17 ± 0.19	0.447	111.9	0.80 ± 0.10 ± 0.10
0.50–0.60	0.533	96.7	1.07 ± 0.12 ± 0.12	0.534	112.7	0.38 ± 0.06 ± 0.06
0.60–0.72	0.647	96.2	0.38 ± 0.06 ± 0.06	0.614	110.2	0.06 ± 0.02 ± 0.02
0.72–0.90	0.755	96.0	0.13 ± 0.03 ± 0.03	0.789	115.4	0.03 ± 0.02 ± 0.02

Table A.22: Double-differential inclusive cross-section $\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$ [mb/(GeV/c sr)] of the production of protons in π^+ + C $\to$ p + X interactions with $+8.0$ GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees.

	$20 < \theta < 30$			$30 < \theta < 40$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.20–0.24	0.220	25.0	59.14 ± 2.39 ± 3.25			
0.24–0.30	0.270	25.0	56.96 ± 1.91 ± 2.92	0.270	34.8	50.77 ± 1.75 ± 2.40
0.30–0.36	0.330	24.9	48.65 ± 1.79 ± 2.44	0.330	35.0	45.74 ± 1.68 ± 1.98
0.36–0.42	0.390	25.1	41.66 ± 1.64 ± 1.97	0.389	35.0	38.91 ± 1.58 ± 1.80
0.42–0.50	0.459	24.9	36.67 ± 1.29 ± 1.63	0.458	34.9	36.26 ± 1.35 ± 1.67
0.50–0.60	0.548	24.9	32.99 ± 1.10 ± 1.44	0.548	34.9	26.81 ± 1.02 ± 1.24
0.60–0.72	0.655	24.8	23.55 ± 0.82 ± 1.12	0.656	34.9	19.48 ± 0.79 ± 1.03
0.72–0.90				0.800	34.9	12.92 ± 0.52 ± 0.81

	$40 < \theta < 50$			$50 < \theta < 60$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.30–0.36	0.329	45.0	48.21 ± 1.67 ± 1.94			
0.36–0.42	0.389	44.9	42.26 ± 1.60 ± 1.59	0.390	55.1	38.50 ± 1.47 ± 1.50
0.42–0.50	0.459	45.1	34.33 ± 1.31 ± 1.48	0.458	54.9	32.67 ± 1.22 ± 1.22
0.50–0.60	0.546	45.0	24.08 ± 1.00 ± 1.22	0.547	55.0	24.18 ± 0.99 ± 1.23
0.60–0.72	0.657	45.0	17.91 ± 0.80 ± 1.03	0.654	55.1	15.46 ± 0.75 ± 0.98
0.72–0.90	0.799	45.0	9.95 ± 0.49 ± 0.71	0.804	54.7	8.94 ± 0.48 ± 0.72
0.90–1.25	1.038	44.9	3.14 ± 0.19 ± 0.33	1.031	54.7	2.19 ± 0.17 ± 0.28

	$60 < \theta < 75$			$75 < \theta < 90$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.42–0.50	0.465	67.2	30.75 ± 0.95 ± 1.11	0.465	81.9	24.19 ± 0.83 ± 1.03
0.50–0.60	0.556	67.3	20.89 ± 0.74 ± 1.07	0.556	81.8	16.56 ± 0.64 ± 0.89
0.60–0.72	0.667	67.2	11.45 ± 0.55 ± 1.01	0.670	81.7	6.81 ± 0.44 ± 0.74
0.72–0.90	0.815	67.2	5.38 ± 0.32 ± 0.64	0.810	81.9	2.94 ± 0.24 ± 0.39

	$90 < \theta < 105$			$105 < \theta < 125$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.42–0.50	0.464	97.3	16.06 ± 0.68 ± 0.90	0.464	113.9	8.69 ± 0.44 ± 0.47
0.50–0.60	0.554	97.1	9.05 ± 0.48 ± 0.62	0.552	113.3	4.23 ± 0.31 ± 0.41
0.60–0.72	0.666	96.4	3.25 ± 0.31 ± 0.42	0.666	112.3	1.19 ± 0.17 ± 0.20
0.72–0.90	0.806	96.4	1.41 ± 0.17 ± 0.22			

Table A.23: Double-differential inclusive cross-section $\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$ [mb/(GeV/c sr)] of the production of π^+'s in π^+ + C $\to$ π^+ + X interactions with $+8.0$ GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees.

	$20 < \theta < 30$					$30 < \theta < 40$				
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$			$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$		
0.10–0.13	0.116	24.5	73.87 ± 3.64	±	5.40	0.115	35.1	43.74 ± 2.67	±	3.20
0.13–0.16	0.146	24.8	86.93 ± 3.61	±	5.09	0.146	34.7	56.44 ± 2.88	±	3.31
0.16–0.20	0.180	24.6	103.34 ± 3.28	±	5.25	0.181	35.1	69.00 ± 2.70	±	3.51
0.20–0.24	0.220	24.8	113.64 ± 3.38	±	5.15	0.220	34.7	74.95 ± 2.74	±	3.37
0.24–0.30	0.270	24.6	109.58 ± 2.68	±	4.43	0.269	34.7	72.77 ± 2.17	±	2.90
0.30–0.36	0.330	24.8	96.55 ± 2.51	±	3.59	0.330	34.5	61.52 ± 1.99	±	2.26
0.36–0.42	0.389	24.6	79.36 ± 2.26	±	2.96	0.389	34.8	52.08 ± 1.81	±	1.89
0.42–0.50	0.458	24.7	64.96 ± 1.75	±	2.71	0.457	34.7	38.58 ± 1.35	±	1.51
0.50–0.60	0.545	24.6	42.20 ± 1.23	±	2.29	0.545	34.7	27.22 ± 1.00	±	1.35
0.60–0.72	0.654	24.6	26.45 ± 0.87	±	2.05	0.655	34.6	15.44 ± 0.66	±	1.07
0.72–0.90						0.796	34.7	7.42 ± 0.35	±	0.79

	$40 < \theta < 50$					$50 < \theta < 60$				
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$			$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$		
0.10–0.13	0.114	44.8	36.45 ± 2.47	±	2.75					
0.13–0.16	0.146	44.8	49.75 ± 2.68	±	2.97	0.145	54.8	35.20 ± 2.25	±	2.20
0.16–0.20	0.180	44.7	50.36 ± 2.27	±	2.58	0.180	54.9	40.59 ± 2.02	±	2.09
0.20–0.24	0.220	44.9	53.48 ± 2.32	±	2.43	0.219	54.9	40.73 ± 2.03	±	1.84
0.24–0.30	0.268	44.7	48.41 ± 1.76	±	1.95	0.269	54.8	34.87 ± 1.51	±	1.39
0.30–0.36	0.330	44.7	44.21 ± 1.69	±	1.64	0.329	54.8	30.61 ± 1.41	±	1.14
0.36–0.42	0.389	44.6	36.38 ± 1.52	±	1.34	0.388	54.8	22.00 ± 1.16	±	0.84
0.42–0.50	0.457	44.5	26.35 ± 1.10	±	1.05	0.459	54.7	16.54 ± 0.88	±	0.70
0.50–0.60	0.545	44.7	16.49 ± 0.78	±	0.80	0.548	54.7	11.99 ± 0.66	±	0.62
0.60–0.72	0.654	44.8	10.45 ± 0.56	±	0.67	0.655	54.4	7.60 ± 0.49	±	0.51
0.72–0.90	0.799	44.6	4.68 ± 0.29	±	0.45	0.799	54.5	2.96 ± 0.23	±	0.28
0.90–1.25						1.034	54.4	0.53 ± 0.06	±	0.08

	$60 < \theta < 75$					$75 < \theta < 90$				
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$			$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$		
0.13–0.16	0.147	67.1	29.25 ± 1.63	±	1.87	0.146	82.2	22.19 ± 1.39	±	1.50
0.16–0.20	0.181	67.0	29.20 ± 1.34	±	1.55	0.182	82.2	25.99 ± 1.26	±	1.37
0.20–0.24	0.221	67.3	31.95 ± 1.44	±	1.42	0.222	82.2	20.38 ± 1.10	±	0.90
0.24–0.30	0.270	66.7	23.76 ± 1.01	±	0.93	0.272	82.0	16.17 ± 0.83	±	0.63
0.30–0.36	0.332	66.9	18.63 ± 0.89	±	0.70	0.330	81.9	10.97 ± 0.67	±	0.44
0.36–0.42	0.393	66.4	14.70 ± 0.78	±	0.59	0.394	82.0	8.62 ± 0.60	±	0.39
0.42–0.50	0.465	66.8	10.86 ± 0.58	±	0.50	0.465	82.0	6.45 ± 0.45	±	0.35
0.50–0.60	0.555	66.5	7.01 ± 0.42	±	0.41	0.553	82.3	3.87 ± 0.31	±	0.27
0.60–0.72	0.665	66.7	4.43 ± 0.30	±	0.35	0.665	82.1	1.98 ± 0.20	±	0.19
0.72–0.90	0.808	66.9	1.60 ± 0.14	±	0.17	0.808	81.6	0.61 ± 0.09	±	0.08
0.90–1.25	1.048	65.5	0.23 ± 0.03	±	0.04	1.016	81.5	0.06 ± 0.02	±	0.02

	$90 < \theta < 105$					$105 < \theta < 125$				
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$			$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$		
0.13–0.16	0.146	97.3	20.75 ± 1.33	±	1.42	0.145	114.9	17.15 ± 1.02	±	1.14
0.16–0.20	0.181	97.4	19.25 ± 1.06	±	1.07	0.181	114.4	13.80 ± 0.77	±	0.74
0.20–0.24	0.221	97.0	16.43 ± 1.00	±	0.72	0.219	114.6	9.72 ± 0.67	±	0.43
0.24–0.30	0.269	97.0	11.40 ± 0.69	±	0.46	0.268	113.8	6.56 ± 0.46	±	0.30
0.30–0.36	0.335	96.9	7.69 ± 0.57	±	0.36	0.331	113.4	3.80 ± 0.35	±	0.23
0.36–0.42	0.394	97.0	5.03 ± 0.46	±	0.29	0.394	113.9	2.79 ± 0.30	±	0.22
0.42–0.50	0.465	96.8	4.00 ± 0.35	±	0.30	0.467	112.7	1.45 ± 0.19	±	0.14
0.50–0.60	0.554	96.0	2.36 ± 0.25	±	0.23	0.550	111.6	0.53 ± 0.10	±	0.07
0.60–0.72	0.664	96.9	0.85 ± 0.13	±	0.11	0.659	110.0	0.20 ± 0.06	±	0.03
0.72–0.90	0.804	96.7	0.17 ± 0.05	±	0.03	0.796	114.1	0.04 ± 0.02	±	0.02
0.90–1.25	1.110	93.1	0.02 ± 0.01	±	0.01					

Table A.24: Double-differential inclusive cross-section $\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$ [mb/(GeV/c sr)] of the production of π^-'s in π^+ + C $\to$ π^- + X interactions with $+8.0$ GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees.

	$20 < \theta < 30$			$30 < \theta < 40$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.10–0.13	0.115	24.5	58.25 ± 3.13 ± 4.25	0.116	34.9	36.92 ± 2.35 ± 2.79
0.13–0.16	0.145	24.9	65.66 ± 3.09 ± 3.90	0.145	34.5	49.88 ± 2.60 ± 3.02
0.16–0.20	0.180	24.8	78.25 ± 2.82 ± 4.00	0.180	34.7	55.01 ± 2.33 ± 2.86
0.20–0.24	0.220	24.6	75.26 ± 2.71 ± 3.39	0.220	34.6	51.20 ± 2.21 ± 2.34
0.24–0.30	0.268	24.7	71.48 ± 2.15 ± 2.82	0.269	34.7	51.75 ± 1.82 ± 2.06
0.30–0.36	0.329	25.0	61.31 ± 2.00 ± 2.24	0.329	34.6	40.08 ± 1.59 ± 1.46
0.36–0.42	0.389	24.7	47.44 ± 1.74 ± 1.74	0.388	34.7	33.99 ± 1.46 ± 1.25
0.42–0.50	0.457	24.6	37.89 ± 1.35 ± 1.57	0.459	34.6	25.69 ± 1.09 ± 1.05
0.50–0.60	0.546	24.7	23.93 ± 0.93 ± 1.24	0.543	34.8	16.20 ± 0.77 ± 0.83
0.60–0.72	0.653	24.7	13.31 ± 0.65 ± 0.91	0.658	34.5	8.49 ± 0.49 ± 0.57
0.72–0.90				0.795	34.8	4.05 ± 0.27 ± 0.38

	$40 < \theta < 50$			$50 < \theta < 60$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.10–0.13	0.115	44.7	29.73 ± 2.11 ± 2.36			
0.13–0.16	0.146	44.9	41.20 ± 2.37 ± 2.55	0.145	54.8	27.68 ± 1.90 ± 1.82
0.16–0.20	0.180	44.9	36.36 ± 1.88 ± 1.91	0.181	54.6	28.08 ± 1.60 ± 1.52
0.20–0.24	0.220	44.7	41.36 ± 2.00 ± 1.92	0.220	54.9	29.09 ± 1.68 ± 1.34
0.24–0.30	0.268	44.9	37.55 ± 1.54 ± 1.51	0.269	54.7	24.56 ± 1.22 ± 0.99
0.30–0.36	0.329	44.6	29.29 ± 1.34 ± 1.09	0.330	54.3	20.57 ± 1.12 ± 0.78
0.36–0.42	0.388	44.6	22.37 ± 1.18 ± 0.85	0.390	54.6	14.79 ± 0.94 ± 0.59
0.42–0.50	0.456	44.8	17.33 ± 0.88 ± 0.75	0.457	54.6	12.40 ± 0.73 ± 0.57
0.50–0.60	0.547	44.8	10.99 ± 0.62 ± 0.61	0.544	54.4	7.04 ± 0.48 ± 0.44
0.60–0.72	0.659	44.7	6.30 ± 0.44 ± 0.45	0.658	54.9	3.62 ± 0.32 ± 0.28
0.72–0.90	0.791	45.0	1.96 ± 0.17 ± 0.22	0.796	53.9	1.34 ± 0.15 ± 0.14
0.90–1.25				1.026	54.2	0.30 ± 0.04 ± 0.05

	$60 < \theta < 75$			$75 < \theta < 90$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.13–0.16	0.145	67.6	20.81 ± 1.30 ± 1.48	0.144	82.4	17.00 ± 1.20 ± 1.18
0.16–0.20	0.178	67.2	22.47 ± 1.18 ± 1.16	0.179	82.4	17.70 ± 1.00 ± 1.05
0.20–0.24	0.219	67.1	21.03 ± 1.14 ± 0.92	0.218	82.4	13.81 ± 0.89 ± 0.64
0.24–0.30	0.265	67.4	18.88 ± 0.89 ± 0.73	0.266	82.1	12.01 ± 0.70 ± 0.47
0.30–0.36	0.326	66.8	12.70 ± 0.72 ± 0.49	0.325	81.8	8.70 ± 0.57 ± 0.39
0.36–0.42	0.384	66.7	10.45 ± 0.62 ± 0.48	0.384	82.0	5.91 ± 0.47 ± 0.32
0.42–0.50	0.454	66.2	7.04 ± 0.45 ± 0.35	0.451	81.4	4.20 ± 0.34 ± 0.27
0.50–0.60	0.535	67.3	4.24 ± 0.30 ± 0.29	0.534	81.8	2.55 ± 0.24 ± 0.20
0.60–0.72	0.642	66.3	2.73 ± 0.24 ± 0.22	0.638	81.3	0.95 ± 0.13 ± 0.10
0.72–0.90	0.775	65.9	0.91 ± 0.10 ± 0.11	0.780	80.9	0.33 ± 0.06 ± 0.05
0.90–1.25	0.993	67.3	0.16 ± 0.03 ± 0.03	1.007	81.8	0.06 ± 0.02 ± 0.02

	$90 < \theta < 105$			$105 < \theta < 125$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.13–0.16	0.144	97.5	14.00 ± 1.06 ± 1.07	0.145	114.4	10.49 ± 0.76 ± 0.81
0.16–0.20	0.179	97.4	13.96 ± 0.90 ± 0.79	0.177	113.9	9.71 ± 0.62 ± 0.63
0.20–0.24	0.219	97.2	11.43 ± 0.81 ± 0.56	0.217	114.0	6.69 ± 0.53 ± 0.36
0.24–0.30	0.265	97.1	7.29 ± 0.51 ± 0.37	0.264	113.9	4.58 ± 0.36 ± 0.26
0.30–0.36	0.327	97.6	4.69 ± 0.42 ± 0.26	0.325	114.1	3.16 ± 0.30 ± 0.22
0.36–0.42	0.383	96.4	3.57 ± 0.37 ± 0.24	0.383	111.7	1.66 ± 0.23 ± 0.15
0.42–0.50	0.453	96.2	2.19 ± 0.25 ± 0.19	0.447	112.9	1.03 ± 0.15 ± 0.12
0.50–0.60	0.526	97.3	1.41 ± 0.19 ± 0.15	0.531	111.8	0.29 ± 0.08 ± 0.04
0.60–0.72	0.639	96.5	0.40 ± 0.09 ± 0.06	0.643	111.3	0.12 ± 0.04 ± 0.03
0.72–0.90	0.758	97.7	0.17 ± 0.05 ± 0.03	0.779	112.4	0.04 ± 0.02 ± 0.02

Table A.25: Double-differential inclusive cross-section $\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$ [mb/(GeV/c sr)] of the production of protons in π^- + C $\rightarrow$ p + X interactions with -8.0 GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees.

	$20 < \theta < 30$					$30 < \theta < 40$				
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$			$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$		
0.20–0.24	0.220	25.1	44.49 ± 1.35	±	2.52					
0.24–0.30	0.268	24.9	40.03 ± 1.03	±	2.11	0.270	34.9	42.54 ± 1.03	±	2.09
0.30–0.36	0.328	25.1	36.04 ± 0.99	±	1.86	0.328	34.9	37.49 ± 0.98	±	1.70
0.36–0.42	0.388	25.0	33.13 ± 0.94	±	1.64	0.389	35.0	32.05 ± 0.92	±	1.55
0.42–0.50	0.456	24.9	29.65 ± 0.76	±	1.40	0.457	35.0	25.59 ± 0.73	±	1.26
0.50–0.60	0.545	25.0	24.02 ± 0.60	±	1.08	0.544	34.9	21.74 ± 0.59	±	1.09
0.60–0.72	0.651	25.1	18.85 ± 0.48	±	0.92	0.652	34.7	16.27 ± 0.47	±	0.87
0.72–0.90						0.794	34.8	10.14 ± 0.30	±	0.66

	$40 < \theta < 50$					$50 < \theta < 60$				
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$			$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$		
0.30–0.36	0.328	45.1	36.95 ± 0.93	±	1.58					
0.36–0.42	0.388	44.8	32.85 ± 0.91	±	1.31	0.388	55.1	33.21 ± 0.89	±	1.26
0.42–0.50	0.456	45.0	26.39 ± 0.73	±	1.20	0.456	54.9	27.40 ± 0.72	±	1.07
0.50–0.60	0.544	45.0	19.70 ± 0.58	±	1.03	0.544	55.0	18.36 ± 0.55	±	0.97
0.60–0.72	0.650	45.0	14.70 ± 0.47	±	0.88	0.651	55.1	12.57 ± 0.44	±	0.83
0.72–0.90	0.791	44.7	7.70 ± 0.28	±	0.57	0.796	54.8	6.39 ± 0.26	±	0.54
0.90–1.25	1.024	44.8	2.34 ± 0.11	±	0.25	1.024	54.8	1.59 ± 0.10	±	0.22

	$60 < \theta < 75$					$75 < \theta < 90$				
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$			$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$		
0.42–0.50	0.446	67.6	26.74 ± 0.57	±	1.04	0.446	82.1	20.88 ± 0.49	±	0.95
0.50–0.60	0.528	67.3	16.25 ± 0.43	±	0.92	0.529	81.8	13.64 ± 0.38	±	0.78
0.60–0.72	0.628	67.2	9.20 ± 0.32	±	0.90	0.630	81.8	5.06 ± 0.25	±	0.67
0.72–0.90	0.760	66.9	4.03 ± 0.18	±	0.53	0.757	81.6	1.97 ± 0.13	±	0.30

	$90 < \theta < 105$					$105 < \theta < 125$				
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$			$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$		
0.42–0.50	0.445	96.8	14.34 ± 0.41	±	0.84	0.444	113.2	7.83 ± 0.27	±	0.45
0.50–0.60	0.526	96.4	7.80 ± 0.28	±	0.55	0.523	113.2	2.45 ± 0.15	±	0.28

Table A.26: Double-differential inclusive cross-section $\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$ [mb/(GeV/c sr)] of the production of π^+'s in π^- + C $\to$ π^+ + X interactions with -8.0 GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees.

	$20 < \theta < 30$			$30 < \theta < 40$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.10–0.13	0.115	24.7	52.34 ± 1.90 ± 3.78	0.116	34.8	33.26 ± 1.45 ± 2.51
0.13–0.16	0.145	24.7	69.64 ± 2.05 ± 4.26	0.146	34.7	46.47 ± 1.65 ± 2.82
0.16–0.20	0.180	24.8	77.34 ± 1.78 ± 3.99	0.180	35.0	50.62 ± 1.44 ± 2.64
0.20–0.24	0.220	24.6	78.02 ± 1.77 ± 3.63	0.220	34.8	54.15 ± 1.46 ± 2.52
0.24–0.30	0.269	24.7	73.21 ± 1.38 ± 3.01	0.269	34.7	52.50 ± 1.16 ± 2.15
0.30–0.36	0.328	24.8	62.50 ± 1.26 ± 2.37	0.328	34.8	43.07 ± 1.04 ± 1.63
0.36–0.42	0.388	24.7	52.36 ± 1.15 ± 1.99	0.386	34.5	36.94 ± 0.97 ± 1.39
0.42–0.50	0.456	24.8	38.12 ± 0.83 ± 1.62	0.456	34.8	26.44 ± 0.70 ± 1.08
0.50–0.60	0.543	24.6	25.35 ± 0.59 ± 1.40	0.544	34.7	16.96 ± 0.48 ± 0.87
0.60–0.72	0.651	24.6	14.58 ± 0.40 ± 1.14	0.649	34.6	9.76 ± 0.33 ± 0.69
0.72–0.90				0.788	34.6	3.69 ± 0.14 ± 0.41

	$40 < \theta < 50$			$50 < \theta < 60$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.10–0.13	0.116	44.8	28.28 ± 1.41 ± 2.21			
0.13–0.16	0.145	45.0	31.00 ± 1.29 ± 1.96	0.145	54.7	25.81 ± 1.21 ± 1.68
0.16–0.20	0.180	44.8	37.70 ± 1.25 ± 2.01	0.179	54.9	28.83 ± 1.06 ± 1.56
0.20–0.24	0.220	44.8	39.38 ± 1.26 ± 1.87	0.220	54.9	30.29 ± 1.10 ± 1.45
0.24–0.30	0.269	44.7	35.21 ± 0.95 ± 1.46	0.268	54.8	26.56 ± 0.84 ± 1.10
0.30–0.36	0.328	44.7	31.11 ± 0.89 ± 1.20	0.328	54.8	22.06 ± 0.73 ± 0.88
0.36–0.42	0.388	44.7	24.50 ± 0.79 ± 0.95	0.387	54.6	17.20 ± 0.65 ± 0.71
0.42–0.50	0.457	44.6	17.06 ± 0.55 ± 0.72	0.456	54.5	12.64 ± 0.48 ± 0.58
0.50–0.60	0.545	44.5	11.76 ± 0.41 ± 0.60	0.543	54.7	7.86 ± 0.33 ± 0.45
0.60–0.72	0.649	44.7	6.12 ± 0.26 ± 0.42	0.652	54.6	3.95 ± 0.19 ± 0.33
0.72–0.90	0.786	44.5	1.83 ± 0.09 ± 0.22	0.790	54.4	1.74 ± 0.11 ± 0.18
0.90–1.25				1.020	54.4	0.33 ± 0.03 ± 0.06

	$60 < \theta < 75$			$75 < \theta < 90$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.13–0.16	0.144	67.2	20.52 ± 0.87 ± 1.36	0.144	82.3	17.18 ± 0.78 ± 1.22
0.16–0.20	0.178	67.0	22.11 ± 0.74 ± 1.23	0.178	82.3	17.69 ± 0.65 ± 1.04
0.20–0.24	0.216	67.2	22.11 ± 0.76 ± 1.04	0.217	82.0	15.69 ± 0.60 ± 0.81
0.24–0.30	0.265	67.2	17.73 ± 0.55 ± 0.72	0.263	82.0	12.58 ± 0.46 ± 0.52
0.30–0.36	0.323	67.0	13.80 ± 0.47 ± 0.55	0.323	81.8	8.53 ± 0.37 ± 0.38
0.36–0.42	0.380	67.0	10.08 ± 0.39 ± 0.49	0.381	82.0	6.22 ± 0.30 ± 0.35
0.42–0.50	0.445	67.0	7.51 ± 0.29 ± 0.40	0.442	81.7	4.85 ± 0.25 ± 0.29
0.50–0.60	0.527	66.7	4.87 ± 0.21 ± 0.32	0.530	81.4	2.50 ± 0.15 ± 0.20
0.60–0.72	0.629	66.3	2.70 ± 0.14 ± 0.23	0.624	80.9	1.22 ± 0.10 ± 0.12
0.72–0.90	0.756	66.5	1.07 ± 0.07 ± 0.12	0.755	81.5	0.40 ± 0.04 ± 0.06
0.90–1.25	0.977	65.8	0.20 ± 0.02 ± 0.04	0.971	81.0	0.06 ± 0.01 ± 0.02

	$90 < \theta < 105$			$105 < \theta < 125$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.13–0.16	0.144	97.4	13.27 ± 0.67 ± 1.00	0.144	114.7	11.30 ± 0.52 ± 0.85
0.16–0.20	0.177	97.5	13.40 ± 0.55 ± 0.82	0.177	114.3	8.84 ± 0.36 ± 0.67
0.20–0.24	0.216	97.2	11.20 ± 0.50 ± 0.62	0.216	113.7	7.65 ± 0.37 ± 0.41
0.24–0.30	0.262	97.3	8.19 ± 0.35 ± 0.39	0.262	113.5	4.45 ± 0.22 ± 0.26
0.30–0.36	0.322	97.2	5.34 ± 0.29 ± 0.29	0.320	114.0	2.93 ± 0.19 ± 0.20
0.36–0.42	0.380	96.9	3.44 ± 0.22 ± 0.26	0.379	112.7	1.78 ± 0.15 ± 0.16
0.42–0.50	0.444	97.0	2.44 ± 0.17 ± 0.20	0.442	112.7	0.91 ± 0.09 ± 0.10
0.50–0.60	0.528	96.1	1.41 ± 0.11 ± 0.15	0.524	112.9	0.22 ± 0.04 ± 0.04
0.60–0.72	0.630	95.8	0.45 ± 0.06 ± 0.06	0.629	111.8	0.06 ± 0.02 ± 0.02
0.72–0.90	0.741	95.5	0.08 ± 0.02 ± 0.02			
0.90–1.25	0.947	95.2	0.03 ± 0.01 ± 0.02			

Table A.27: Double-differential inclusive cross-section $\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$ [mb/(GeV/c sr)] of the production of π^-'s in π^- + C $\to$ π^- + X interactions with -8.0 GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees.

	$20 < \theta < 30$					$30 < \theta < 40$				
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$			$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$		
0.10–0.13	0.116	24.6	74.70 ± 2.28	±	5.41	0.115	34.8	52.24 ± 1.86	±	3.96
0.13–0.16	0.146	24.6	96.72 ± 2.43	±	5.85	0.146	34.7	66.90 ± 1.97	±	4.07
0.16–0.20	0.181	24.6	108.51 ± 2.13	±	5.56	0.180	34.7	78.21 ± 1.81	±	4.07
0.20–0.24	0.221	24.7	116.47 ± 2.19	±	5.29	0.221	34.6	81.93 ± 1.82	±	3.75
0.24–0.30	0.270	24.7	116.31 ± 1.78	±	4.68	0.271	34.7	74.90 ± 1.40	±	2.99
0.30–0.36	0.330	24.8	97.69 ± 1.61	±	3.56	0.330	34.7	67.90 ± 1.36	±	2.52
0.36–0.42	0.391	24.8	80.50 ± 1.47	±	3.00	0.391	34.6	49.26 ± 1.11	±	1.83
0.42–0.50	0.460	24.6	59.96 ± 1.08	±	2.49	0.460	34.7	40.96 ± 0.90	±	1.68
0.50–0.60	0.549	24.7	41.38 ± 0.81	±	2.15	0.549	34.7	28.14 ± 0.66	±	1.43
0.60–0.72	0.658	24.7	25.15 ± 0.58	±	1.72	0.657	34.6	16.06 ± 0.46	±	1.07
0.72–0.90						0.802	34.7	6.44 ± 0.23	±	0.59

	$40 < \theta < 50$					$50 < \theta < 60$				
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$			$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$		
0.10–0.13	0.116	44.9	36.56 ± 1.49	±	2.98					
0.13–0.16	0.145	44.9	48.57 ± 1.68	±	3.02	0.145	54.8	36.93 ± 1.42	±	2.45
0.16–0.20	0.180	44.8	53.85 ± 1.50	±	2.85	0.180	54.9	41.73 ± 1.29	±	2.24
0.20–0.24	0.220	44.7	53.90 ± 1.45	±	2.52	0.220	54.9	40.55 ± 1.27	±	1.90
0.24–0.30	0.269	44.7	49.60 ± 1.14	±	2.01	0.269	54.7	35.31 ± 0.97	±	1.44
0.30–0.36	0.330	44.7	42.47 ± 1.03	±	1.59	0.330	54.7	29.17 ± 0.85	±	1.13
0.36–0.42	0.390	44.7	36.33 ± 0.96	±	1.40	0.391	54.7	23.21 ± 0.79	±	0.94
0.42–0.50	0.460	44.7	26.75 ± 0.71	±	1.15	0.459	54.6	16.81 ± 0.57	±	0.76
0.50–0.60	0.547	44.7	18.13 ± 0.53	±	0.98	0.548	54.8	11.08 ± 0.41	±	0.63
0.60–0.72	0.658	44.7	10.61 ± 0.37	±	0.75	0.658	54.7	7.21 ± 0.31	±	0.53
0.72–0.90	0.804	44.8	4.73 ± 0.20	±	0.46	0.799	54.7	2.62 ± 0.14	±	0.26
0.90–1.25						1.048	54.4	0.62 ± 0.04	±	0.10

	$60 < \theta < 75$					$75 < \theta < 90$				
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$			$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$		
0.13–0.16	0.146	67.2	29.40 ± 1.02	±	1.94	0.146	82.2	21.74 ± 0.86	±	1.55
0.16–0.20	0.182	67.0	31.02 ± 0.88	±	1.64	0.182	82.3	22.27 ± 0.73	±	1.25
0.20–0.24	0.223	67.2	29.93 ± 0.89	±	1.33	0.222	82.1	20.44 ± 0.72	±	0.91
0.24–0.30	0.275	66.9	24.33 ± 0.64	±	0.96	0.273	82.3	17.59 ± 0.55	±	0.71
0.30–0.36	0.335	66.8	19.37 ± 0.58	±	0.75	0.334	81.9	11.02 ± 0.42	±	0.47
0.36–0.42	0.398	67.2	14.59 ± 0.48	±	0.64	0.398	81.8	8.27 ± 0.37	±	0.41
0.42–0.50	0.470	66.8	10.84 ± 0.37	±	0.54	0.468	81.9	6.29 ± 0.28	±	0.38
0.50–0.60	0.564	66.9	7.51 ± 0.27	±	0.47	0.562	81.7	3.63 ± 0.19	±	0.28
0.60–0.72	0.682	66.5	4.06 ± 0.19	±	0.33	0.684	81.6	1.86 ± 0.12	±	0.19
0.72–0.90	0.831	67.2	1.52 ± 0.09	±	0.17	0.831	81.3	0.67 ± 0.06	±	0.10
0.90–1.25	1.080	67.1	0.22 ± 0.02	±	0.04	1.092	81.0	0.13 ± 0.02	±	0.03

	$90 < \theta < 105$					$105 < \theta < 125$				
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$			$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$		
0.13–0.16	0.146	97.4	20.11 ± 0.82	±	1.49	0.146	114.6	14.72 ± 0.59	±	1.11
0.16–0.20	0.182	97.3	19.04 ± 0.68	±	1.06	0.181	113.7	14.46 ± 0.51	±	0.77
0.20–0.24	0.221	96.9	16.26 ± 0.62	±	0.79	0.221	114.2	10.76 ± 0.46	±	0.50
0.24–0.30	0.273	97.1	11.50 ± 0.44	±	0.50	0.273	114.2	5.96 ± 0.28	±	0.31
0.30–0.36	0.334	96.5	8.13 ± 0.39	±	0.42	0.335	113.6	4.66 ± 0.25	±	0.32
0.36–0.42	0.397	96.7	5.67 ± 0.31	±	0.37	0.396	113.6	2.73 ± 0.18	±	0.25
0.42–0.50	0.470	96.8	3.47 ± 0.21	±	0.28	0.467	112.2	1.53 ± 0.12	±	0.18
0.50–0.60	0.563	96.6	1.95 ± 0.14	±	0.21	0.562	113.0	0.77 ± 0.08	±	0.11
0.60–0.72	0.677	96.5	0.94 ± 0.09	±	0.14	0.676	111.5	0.24 ± 0.04	±	0.05
0.72–0.90	0.820	97.2	0.28 ± 0.04	±	0.06	0.818	111.2	0.05 ± 0.02	±	0.02
0.90–1.25	1.074	95.2	0.04 ± 0.01	±	0.02					

Table A.28: Double-differential inclusive cross-section $\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$ [mb/(GeV/c sr)] of the production of protons in p + C $\rightarrow$ p + X interactions with $+12.0$ GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees.

	$20 < \theta < 30$			$30 < \theta < 40$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.20–0.24	0.221	25.0	68.99 ± 1.66 ± 3.77			
0.24–0.30	0.271	25.0	66.65 ± 1.33 ± 3.40	0.271	34.9	60.61 ± 1.22 ± 2.91
0.30–0.36	0.331	24.9	58.03 ± 1.23 ± 2.90	0.331	34.9	58.98 ± 1.22 ± 2.55
0.36–0.42	0.391	25.0	54.77 ± 1.21 ± 2.55	0.391	35.0	49.99 ± 1.16 ± 2.27
0.42–0.50	0.460	25.0	49.10 ± 0.97 ± 2.15	0.461	34.9	43.04 ± 0.95 ± 2.01
0.50–0.60	0.551	25.0	43.41 ± 0.81 ± 1.85	0.551	34.9	35.85 ± 0.76 ± 1.66
0.60–0.72	0.661	24.9	35.09 ± 0.66 ± 1.63	0.661	34.9	28.86 ± 0.63 ± 1.47
0.72–0.90				0.808	34.9	19.46 ± 0.42 ± 1.22

	$40 < \theta < 50$			$50 < \theta < 60$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.30–0.36	0.331	45.1	57.68 ± 1.18 ± 2.30			
0.36–0.42	0.391	44.9	50.22 ± 1.13 ± 1.88	0.391	55.0	53.00 ± 1.13 ± 1.93
0.42–0.50	0.461	44.9	41.12 ± 0.92 ± 1.74	0.461	55.0	40.70 ± 0.88 ± 1.54
0.50–0.60	0.551	45.0	33.47 ± 0.76 ± 1.64	0.550	54.9	29.60 ± 0.70 ± 1.49
0.60–0.72	0.661	44.8	25.04 ± 0.60 ± 1.37	0.659	55.0	20.17 ± 0.55 ± 1.25
0.72–0.90	0.806	44.8	14.46 ± 0.38 ± 1.02	0.806	54.8	11.67 ± 0.35 ± 0.93
0.90–1.25	1.049	44.8	5.11 ± 0.16 ± 0.52	1.049	54.9	3.38 ± 0.14 ± 0.42

	$60 < \theta < 75$			$75 < \theta < 90$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.42–0.50	0.459	67.3	38.59 ± 0.68 ± 1.45	0.457	82.1	30.70 ± 0.60 ± 1.33
0.50–0.60	0.546	67.4	26.79 ± 0.55 ± 1.35	0.545	81.9	20.22 ± 0.45 ± 1.07
0.60–0.72	0.655	67.0	14.99 ± 0.41 ± 1.30	0.654	81.6	8.97 ± 0.32 ± 0.92
0.72–0.90	0.796	66.8	7.36 ± 0.24 ± 0.84	0.796	81.5	3.74 ± 0.18 ± 0.49

	$90 < \theta < 105$			$105 < \theta < 125$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.42–0.50	0.457	96.7	19.14 ± 0.48 ± 1.09	0.456	113.2	9.58 ± 0.30 ± 0.53
0.50–0.60	0.546	96.6	11.14 ± 0.34 ± 0.76	0.543	113.1	3.84 ± 0.19 ± 0.37
0.60–0.72	0.653	96.2	4.20 ± 0.22 ± 0.50	0.649	112.8	1.40 ± 0.12 ± 0.23
0.72–0.90	0.789	96.4	1.46 ± 0.12 ± 0.23	0.784	112.5	0.41 ± 0.05 ± 0.09

Table A.29: Double-differential inclusive cross-section $\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$ [mb/(GeV/c sr)] of the production of π^+'s in p + C $\to \pi^+$ + X interactions with $+12.0$ GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees.

	$20 < \theta < 30$					$30 < \theta < 40$				
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$			$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$		
0.10–0.13	0.116	24.8	73.94 ± 2.31	±	5.16	0.116	34.8	53.58 ± 1.92	±	3.92
0.13–0.16	0.146	24.5	95.69 ± 2.45	±	5.62	0.145	34.8	62.55 ± 1.95	±	3.66
0.16–0.20	0.181	24.6	107.79 ± 2.15	±	5.42	0.181	34.7	70.85 ± 1.75	±	3.58
0.20–0.24	0.221	24.6	111.00 ± 2.15	±	5.00	0.220	34.6	72.55 ± 1.72	±	3.26
0.24–0.30	0.270	24.8	104.00 ± 1.68	±	4.16	0.270	34.6	68.16 ± 1.35	±	2.70
0.30–0.36	0.329	24.7	91.01 ± 1.56	±	3.35	0.331	34.6	61.21 ± 1.29	±	2.23
0.36–0.42	0.391	24.7	75.17 ± 1.41	±	2.76	0.390	34.6	49.59 ± 1.15	±	1.79
0.42–0.50	0.460	24.7	54.32 ± 1.03	±	2.27	0.460	34.7	37.32 ± 0.86	±	1.46
0.50–0.60	0.550	24.8	37.39 ± 0.74	±	2.03	0.549	34.8	25.00 ± 0.61	±	1.24
0.60–0.72	0.661	24.6	21.57 ± 0.49	±	1.67	0.658	34.7	13.98 ± 0.40	±	0.98
0.72–0.90						0.805	34.7	6.77 ± 0.21	±	0.73

	$40 < \theta < 50$					$50 < \theta < 60$				
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$			$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$		
0.10–0.13	0.116	44.8	34.94 ± 1.49	±	2.69					
0.13–0.16	0.146	44.7	44.94 ± 1.63	±	2.68	0.145	55.0	37.32 ± 1.48	±	2.34
0.16–0.20	0.181	44.8	52.74 ± 1.49	±	2.70	0.180	54.8	41.89 ± 1.32	±	2.15
0.20–0.24	0.221	44.7	50.99 ± 1.46	±	2.32	0.220	54.8	41.24 ± 1.30	±	1.87
0.24–0.30	0.270	44.7	48.29 ± 1.14	±	1.94	0.270	54.8	34.90 ± 0.98	±	1.39
0.30–0.36	0.330	44.6	41.61 ± 1.05	±	1.54	0.330	54.6	29.58 ± 0.87	±	1.11
0.36–0.42	0.389	44.7	32.71 ± 0.93	±	1.22	0.390	54.7	22.55 ± 0.76	±	0.88
0.42–0.50	0.460	44.6	24.05 ± 0.69	±	0.96	0.460	54.5	17.44 ± 0.58	±	0.75
0.50–0.60	0.549	44.7	16.12 ± 0.49	±	0.78	0.551	54.6	12.18 ± 0.44	±	0.63
0.60–0.72	0.658	44.5	9.98 ± 0.35	±	0.65	0.656	54.7	6.38 ± 0.29	±	0.44
0.72–0.90	0.803	44.5	4.47 ± 0.18	±	0.43	0.804	54.4	2.64 ± 0.14	±	0.25
0.90–1.25						1.031	54.6	0.54 ± 0.04	±	0.09

	$60 < \theta < 75$					$75 < \theta < 90$				
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$			$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$		
0.13–0.16	0.146	67.5	29.90 ± 1.06	±	1.94	0.145	82.3	21.62 ± 0.86	±	1.60
0.16–0.20	0.180	67.4	28.97 ± 0.86	±	1.55	0.180	82.3	24.97 ± 0.79	±	1.37
0.20–0.24	0.220	67.3	29.75 ± 0.90	±	1.33	0.219	82.1	22.82 ± 0.77	±	0.99
0.24–0.30	0.269	66.9	23.88 ± 0.65	±	0.93	0.269	82.0	18.06 ± 0.56	±	0.70
0.30–0.36	0.328	67.2	18.52 ± 0.58	±	0.70	0.327	81.8	11.81 ± 0.45	±	0.47
0.36–0.42	0.389	66.7	13.21 ± 0.47	±	0.53	0.389	81.9	8.57 ± 0.38	±	0.39
0.42–0.50	0.458	67.0	10.26 ± 0.36	±	0.48	0.458	81.7	5.54 ± 0.27	±	0.31
0.50–0.60	0.546	66.5	6.57 ± 0.26	±	0.39	0.546	81.5	3.81 ± 0.20	±	0.28
0.60–0.72	0.650	66.2	3.39 ± 0.17	±	0.27	0.650	81.3	1.43 ± 0.11	±	0.14
0.72–0.90	0.790	66.3	1.26 ± 0.08	±	0.14	0.793	81.2	0.47 ± 0.05	±	0.06
0.90–1.25	1.007	65.9	0.21 ± 0.02	±	0.04	1.035	80.9	0.07 ± 0.02	±	0.02

	$90 < \theta < 105$					$105 < \theta < 125$				
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$			$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$		
0.13–0.16	0.145	97.5	19.52 ± 0.83	±	1.37	0.145	114.4	15.42 ± 0.61	±	1.12
0.16–0.20	0.179	97.3	19.24 ± 0.68	±	1.10	0.178	114.5	13.84 ± 0.49	±	0.79
0.20–0.24	0.219	97.0	16.06 ± 0.63	±	0.74	0.218	114.3	10.48 ± 0.44	±	0.48
0.24–0.30	0.268	97.2	11.82 ± 0.46	±	0.48	0.267	113.4	5.98 ± 0.28	±	0.29
0.30–0.36	0.328	96.9	7.06 ± 0.35	±	0.34	0.330	113.4	3.79 ± 0.22	±	0.24
0.36–0.42	0.388	96.7	5.45 ± 0.31	±	0.33	0.388	113.9	2.48 ± 0.18	±	0.21
0.42–0.50	0.456	96.5	3.03 ± 0.19	±	0.23	0.451	112.5	1.27 ± 0.11	±	0.13
0.50–0.60	0.542	95.9	1.69 ± 0.13	±	0.17	0.540	112.6	0.41 ± 0.05	±	0.06
0.60–0.72	0.653	95.3	0.63 ± 0.07	±	0.09	0.643	109.8	0.17 ± 0.03	±	0.03
0.72–0.90	0.784	96.9	0.15 ± 0.03	±	0.03					

Table A.30: Double-differential inclusive cross-section $\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$ [mb/(GeV/c sr)] of the production of π^-'s in p + C $\to \pi^-$ + X interactions with $+12.0$ GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees.

	$20 < \theta < 30$			$30 < \theta < 40$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.10–0.13	0.116	24.6	74.95 ± 2.25 ± 5.27	0.115	34.7	49.76 ± 1.76 ± 3.77
0.13–0.16	0.145	24.7	88.24 ± 2.30 ± 5.17	0.146	34.7	63.80 ± 1.93 ± 3.84
0.16–0.20	0.180	24.6	101.08 ± 2.05 ± 5.12	0.180	34.7	67.58 ± 1.66 ± 3.48
0.20–0.24	0.219	24.7	103.57 ± 2.06 ± 4.62	0.219	34.6	70.04 ± 1.68 ± 3.16
0.24–0.30	0.269	24.8	90.51 ± 1.55 ± 3.52	0.268	34.8	62.64 ± 1.28 ± 2.46
0.30–0.36	0.328	24.8	73.20 ± 1.41 ± 2.62	0.328	34.7	50.44 ± 1.14 ± 1.82
0.36–0.42	0.387	24.6	58.42 ± 1.25 ± 2.12	0.387	34.7	42.14 ± 1.05 ± 1.53
0.42–0.50	0.456	24.8	44.33 ± 0.94 ± 1.82	0.455	34.6	30.18 ± 0.76 ± 1.23
0.50–0.60	0.543	24.8	27.80 ± 0.67 ± 1.43	0.544	34.7	18.69 ± 0.53 ± 0.95
0.60–0.72	0.648	24.8	15.01 ± 0.43 ± 1.03	0.648	34.6	9.95 ± 0.34 ± 0.69
0.72–0.90				0.788	34.9	4.71 ± 0.19 ± 0.43

	$40 < \theta < 50$			$50 < \theta < 60$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.10–0.13	0.116	44.7	39.32 ± 1.54 ± 3.21			
0.13–0.16	0.145	45.0	47.04 ± 1.61 ± 2.93	0.144	54.8	35.43 ± 1.37 ± 2.38
0.16–0.20	0.179	44.7	48.36 ± 1.36 ± 2.56	0.180	54.9	39.89 ± 1.26 ± 2.09
0.20–0.24	0.220	44.6	52.12 ± 1.46 ± 2.39	0.219	54.9	37.72 ± 1.22 ± 1.71
0.24–0.30	0.269	44.9	44.96 ± 1.08 ± 1.78	0.268	54.7	32.25 ± 0.90 ± 1.27
0.30–0.36	0.328	44.7	36.21 ± 0.96 ± 1.33	0.329	54.8	24.76 ± 0.79 ± 0.93
0.36–0.42	0.387	44.9	30.21 ± 0.88 ± 1.14	0.386	54.9	18.92 ± 0.68 ± 0.77
0.42–0.50	0.455	44.9	19.09 ± 0.58 ± 0.85	0.454	54.8	13.49 ± 0.48 ± 0.70
0.50–0.60	0.542	44.7	14.08 ± 0.46 ± 0.76	0.543	54.9	9.62 ± 0.39 ± 0.54
0.60–0.72	0.650	45.0	7.55 ± 0.30 ± 0.55	0.651	54.7	4.91 ± 0.24 ± 0.37
0.72–0.90	0.787	44.7	2.90 ± 0.15 ± 0.29	0.786	54.4	2.01 ± 0.13 ± 0.20
0.90–1.25				1.020	54.6	0.27 ± 0.03 ± 0.05

	$60 < \theta < 75$			$75 < \theta < 90$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.13–0.16	0.145	67.4	27.50 ± 0.97 ± 1.90	0.145	82.3	23.21 ± 0.91 ± 1.62
0.16–0.20	0.180	67.1	31.08 ± 0.88 ± 1.65	0.180	82.5	22.77 ± 0.72 ± 1.39
0.20–0.24	0.219	67.3	29.04 ± 0.86 ± 1.26	0.219	82.0	19.48 ± 0.68 ± 0.94
0.24–0.30	0.268	67.0	22.82 ± 0.62 ± 0.87	0.268	82.2	14.54 ± 0.48 ± 0.61
0.30–0.36	0.328	66.9	16.82 ± 0.52 ± 0.66	0.328	82.0	9.88 ± 0.40 ± 0.43
0.36–0.42	0.388	66.7	11.97 ± 0.43 ± 0.54	0.388	81.7	7.84 ± 0.36 ± 0.39
0.42–0.50	0.458	66.8	8.45 ± 0.32 ± 0.43	0.456	81.8	4.84 ± 0.23 ± 0.31
0.50–0.60	0.547	66.9	5.29 ± 0.22 ± 0.35	0.544	81.8	2.54 ± 0.15 ± 0.21
0.60–0.72	0.654	66.5	2.73 ± 0.15 ± 0.23	0.656	81.2	0.94 ± 0.08 ± 0.10
0.72–0.90	0.790	67.0	0.94 ± 0.07 ± 0.11	0.794	81.9	0.31 ± 0.04 ± 0.04
0.90–1.25	1.023	66.3	0.11 ± 0.02 ± 0.02	1.004	83.1	0.03 ± 0.01 ± 0.01

	$90 < \theta < 105$			$105 < \theta < 125$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.13–0.16	0.146	97.6	18.86 ± 0.78 ± 1.49	0.145	114.5	13.81 ± 0.55 ± 1.13
0.16–0.20	0.179	97.2	18.37 ± 0.65 ± 1.16	0.179	114.2	12.20 ± 0.44 ± 0.87
0.20–0.24	0.220	97.2	13.92 ± 0.57 ± 0.73	0.220	113.8	8.17 ± 0.37 ± 0.49
0.24–0.30	0.267	96.9	9.06 ± 0.38 ± 0.43	0.266	113.9	5.57 ± 0.26 ± 0.31
0.30–0.36	0.327	96.9	5.88 ± 0.30 ± 0.33	0.325	113.9	3.29 ± 0.20 ± 0.24
0.36–0.42	0.388	96.7	4.71 ± 0.27 ± 0.32	0.385	112.9	1.95 ± 0.15 ± 0.18
0.42–0.50	0.456	96.7	2.69 ± 0.18 ± 0.23	0.452	113.2	0.88 ± 0.09 ± 0.11
0.50–0.60	0.542	96.4	1.30 ± 0.11 ± 0.15	0.547	112.0	0.30 ± 0.05 ± 0.05
0.60–0.72	0.650	95.9	0.59 ± 0.07 ± 0.09	0.630	111.0	0.07 ± 0.02 ± 0.02
0.72–0.90	0.784	95.7	0.10 ± 0.02 ± 0.02			
0.90–1.25	0.947	97.0	0.03 ± 0.01 ± 0.01			

Table A.31: Double-differential inclusive cross-section $\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$ [mb/(GeV/c sr)] of the production of protons in π^+ + C $\to$ p + X interactions with $+12.0$ GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees.

	$20 < \theta < 30$					$30 < \theta < 40$				
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$			$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$		
0.20–0.24	0.220	24.9	50.29 ± 4.70	±	2.79					
0.24–0.30	0.269	25.0	46.89 ± 3.72	±	2.44	0.271	34.6	49.83 ± 3.68	±	2.41
0.30–0.36	0.330	25.0	35.48 ± 3.21	±	1.80	0.331	35.0	40.52 ± 3.38	±	1.78
0.36–0.42	0.389	24.9	39.18 ± 3.39	±	1.86	0.389	35.0	35.79 ± 3.27	±	1.64
0.42–0.50	0.458	24.6	29.80 ± 2.47	±	1.33	0.462	34.5	29.86 ± 2.62	±	1.41
0.50–0.60	0.551	25.1	28.84 ± 2.16	±	1.26	0.551	35.1	26.96 ± 2.18	±	1.27
0.60–0.72	0.660	25.0	21.25 ± 1.67	±	1.01	0.664	34.8	19.28 ± 1.68	±	1.00
0.72–0.90						0.800	35.1	12.50 ± 1.12	±	0.79

	$40 < \theta < 50$					$50 < \theta < 60$				
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$			$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$		
0.30–0.36	0.329	45.1	43.68 ± 3.42	±	1.77					
0.36–0.42	0.392	45.3	37.40 ± 3.23	±	1.43	0.391	55.2	38.12 ± 3.19	±	1.42
0.42–0.50	0.462	45.3	31.03 ± 2.65	±	1.33	0.459	54.9	34.31 ± 2.68	±	1.33
0.50–0.60	0.548	44.4	22.20 ± 2.04	±	1.10	0.555	55.2	22.16 ± 2.02	±	1.13
0.60–0.72	0.661	45.0	16.57 ± 1.63	±	0.92	0.665	54.9	14.22 ± 1.54	±	0.89
0.72–0.90	0.810	44.8	10.95 ± 1.09	±	0.78	0.803	55.3	7.36 ± 0.92	±	0.59
0.90–1.25	1.046	44.8	3.85 ± 0.46	±	0.39	1.041	54.4	2.38 ± 0.39	±	0.30

	$60 < \theta < 75$					$75 < \theta < 90$				
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$			$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$		
0.42–0.50	0.458	67.5	28.31 ± 1.94	±	1.09	0.458	82.2	25.31 ± 1.82	±	1.11
0.50–0.60	0.545	67.0	19.98 ± 1.56	±	1.02	0.549	82.0	14.01 ± 1.26	±	0.75
0.60–0.72	0.658	66.9	10.96 ± 1.15	±	0.94	0.650	81.9	5.49 ± 0.83	±	0.55
0.72–0.90	0.799	66.0	5.86 ± 0.71	±	0.66	0.791	81.6	2.97 ± 0.52	±	0.38

	$90 < \theta < 105$					$105 < \theta < 125$				
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$			$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$		
0.42–0.50	0.453	96.5	13.60 ± 1.33	±	0.78	0.461	113.8	7.74 ± 0.89	±	0.43
0.50–0.60	0.545	96.1	8.94 ± 1.02	±	0.62	0.543	113.3	2.56 ± 0.52	±	0.25
0.60–0.72	0.661	96.6	3.97 ± 0.72	±	0.47	0.641	113.7	0.73 ± 0.29	±	0.12
0.72–0.90	0.785	96.2	1.26 ± 0.35	±	0.19	0.786	111.6	0.31 ± 0.15	±	0.07

Table A.32: Double-differential inclusive cross-section $\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$ [mb/(GeV/c sr)] of the production of π^+'s in π^+ + C $\to \pi^+$ + X interactions with $+12.0$ GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees.

	$20 < \theta < 30$			$30 < \theta < 40$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.10–0.13	0.117	24.7	58.96 ± 6.90 ± 4.25	0.118	34.4	44.65 ± 5.81 ± 3.27
0.13–0.16	0.148	25.0	77.28 ± 7.46 ± 4.67	0.146	34.1	47.31 ± 5.67 ± 2.79
0.16–0.20	0.181	24.7	100.30 ± 6.95 ± 5.11	0.179	34.9	67.53 ± 5.80 ± 3.45
0.20–0.24	0.221	24.6	106.13 ± 7.02 ± 4.83	0.221	34.7	78.09 ± 5.97 ± 3.54
0.24–0.30	0.270	24.2	106.05 ± 5.65 ± 4.30	0.269	34.6	59.17 ± 4.19 ± 2.38
0.30–0.36	0.330	24.6	96.21 ± 5.36 ± 3.60	0.329	34.5	66.72 ± 4.46 ± 2.47
0.36–0.42	0.390	24.6	77.56 ± 4.77 ± 2.89	0.392	34.7	47.44 ± 3.76 ± 1.74
0.42–0.50	0.463	24.5	57.94 ± 3.57 ± 2.45	0.460	34.8	38.29 ± 2.93 ± 1.52
0.50–0.60	0.545	24.3	39.38 ± 2.54 ± 2.15	0.553	34.7	23.10 ± 1.95 ± 1.15
0.60–0.72	0.660	24.5	21.17 ± 1.65 ± 1.64	0.659	34.5	13.25 ± 1.30 ± 0.93
0.72–0.90				0.804	35.1	6.01 ± 0.69 ± 0.65

	$40 < \theta < 50$			$50 < \theta < 60$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.10–0.13	0.115	45.1	28.14 ± 4.58 ± 2.14			
0.13–0.16	0.145	45.0	40.29 ± 5.19 ± 2.41	0.145	54.4	36.85 ± 4.87 ± 2.30
0.16–0.20	0.181	45.1	46.24 ± 4.66 ± 2.38	0.179	54.7	40.35 ± 4.33 ± 2.08
0.20–0.24	0.221	44.0	48.19 ± 4.76 ± 2.22	0.221	54.9	33.46 ± 3.97 ± 1.54
0.24–0.30	0.272	44.8	45.83 ± 3.70 ± 1.86	0.267	54.8	35.84 ± 3.30 ± 1.45
0.30–0.36	0.331	44.8	37.66 ± 3.36 ± 1.41	0.330	54.6	28.10 ± 2.85 ± 1.07
0.36–0.42	0.391	44.9	35.70 ± 3.26 ± 1.35	0.393	54.5	24.54 ± 2.65 ± 0.96
0.42–0.50	0.457	44.4	22.78 ± 2.21 ± 0.92	0.460	54.2	11.07 ± 1.54 ± 0.47
0.50–0.60	0.546	44.7	18.30 ± 1.75 ± 0.89	0.549	54.6	13.02 ± 1.50 ± 0.67
0.60–0.72	0.662	44.6	10.34 ± 1.22 ± 0.67	0.666	54.3	7.64 ± 1.06 ± 0.52
0.72–0.90	0.801	44.7	4.43 ± 0.61 ± 0.42	0.805	54.8	3.75 ± 0.58 ± 0.35
0.90–1.25				1.014	54.3	0.52 ± 0.12 ± 0.09

	$60 < \theta < 75$			$75 < \theta < 90$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.13–0.16	0.145	67.9	31.12 ± 3.62 ± 2.01	0.144	81.3	20.12 ± 2.78 ± 1.47
0.16–0.20	0.180	67.1	25.73 ± 2.72 ± 1.37	0.180	83.2	25.52 ± 2.69 ± 1.38
0.20–0.24	0.219	66.6	32.39 ± 3.14 ± 1.46	0.218	82.5	19.83 ± 2.40 ± 0.87
0.24–0.30	0.270	66.8	19.48 ± 1.95 ± 0.77	0.270	82.5	12.85 ± 1.60 ± 0.51
0.30–0.36	0.326	66.7	16.14 ± 1.81 ± 0.62	0.330	81.5	11.64 ± 1.50 ± 0.47
0.36–0.42	0.387	67.4	13.79 ± 1.62 ± 0.56	0.391	81.6	8.03 ± 1.24 ± 0.37
0.42–0.50	0.460	66.5	9.97 ± 1.18 ± 0.46	0.461	82.8	6.89 ± 1.01 ± 0.38
0.50–0.60	0.542	66.6	6.62 ± 0.87 ± 0.39	0.546	80.2	4.13 ± 0.69 ± 0.30
0.60–0.72	0.661	67.0	3.76 ± 0.59 ± 0.29	0.653	80.4	1.83 ± 0.40 ± 0.18
0.72–0.90	0.808	66.3	1.58 ± 0.29 ± 0.18	0.782	81.5	0.61 ± 0.19 ± 0.08
0.90–1.25	1.003	64.9	0.32 ± 0.07 ± 0.06	0.937	78.6	0.08 ± 0.04 ± 0.02

	$90 < \theta < 105$			$105 < \theta < 125$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.13–0.16	0.146	98.4	15.44 ± 2.49 ± 1.07	0.146	114.4	16.64 ± 2.14 ± 1.17
0.16–0.20	0.178	97.2	17.64 ± 2.18 ± 1.00	0.181	114.7	12.39 ± 1.57 ± 0.69
0.20–0.24	0.219	97.9	14.27 ± 1.99 ± 0.65	0.220	115.9	10.28 ± 1.48 ± 0.47
0.24–0.30	0.266	96.6	8.99 ± 1.35 ± 0.37	0.268	112.8	4.55 ± 0.82 ± 0.22
0.30–0.36	0.333	97.3	8.75 ± 1.31 ± 0.42	0.330	113.8	4.42 ± 0.82 ± 0.27
0.36–0.42	0.386	97.5	4.15 ± 0.89 ± 0.25	0.389	112.8	3.02 ± 0.65 ± 0.24
0.42–0.50	0.449	99.0	2.60 ± 0.60 ± 0.20	0.456	110.5	1.65 ± 0.43 ± 0.17
0.50–0.60	0.560	96.5	1.75 ± 0.44 ± 0.18	0.541	111.4	0.97 ± 0.28 ± 0.13
0.60–0.72	0.665	95.2	0.61 ± 0.24 ± 0.08	0.650	117.4	0.13 ± 0.10 ± 0.02

Table A.33: Double-differential inclusive cross-section $\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$ [mb/(GeV/c sr)] of the production of π^-'s in π^+ + C $\to \pi^-$ + X interactions with $+12.0$ GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees.

	$20 < \theta < 30$					$30 < \theta < 40$				
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$			$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$		
0.10–0.13	0.115	24.7	67.55 ± 7.21	±	4.82	0.115	35.0	41.76 ± 5.49	±	3.14
0.13–0.16	0.146	24.9	73.12 ± 7.05	±	4.34	0.143	34.4	49.10 ± 5.68	±	2.97
0.16–0.20	0.180	24.7	77.79 ± 6.00	±	3.98	0.179	34.5	60.04 ± 5.22	±	3.12
0.20–0.24	0.219	24.7	94.47 ± 6.53	±	4.26	0.219	34.5	69.63 ± 5.55	±	3.18
0.24–0.30	0.268	24.4	82.45 ± 4.89	±	3.26	0.267	34.4	68.21 ± 4.42	±	2.72
0.30–0.36	0.329	24.8	71.72 ± 4.62	±	2.61	0.329	34.6	49.82 ± 3.76	±	1.83
0.36–0.42	0.385	24.8	54.95 ± 4.05	±	2.02	0.391	34.9	31.59 ± 3.02	±	1.17
0.42–0.50	0.453	24.6	38.68 ± 2.92	±	1.60	0.453	34.7	22.79 ± 2.20	±	0.94
0.50–0.60	0.543	24.8	27.76 ± 2.22	±	1.44	0.541	34.9	17.61 ± 1.72	±	0.90
0.60–0.72	0.649	24.4	15.73 ± 1.46	±	1.08	0.645	34.4	8.20 ± 1.03	±	0.57
0.72–0.90						0.791	34.5	4.84 ± 0.65	±	0.44

	$40 < \theta < 50$					$50 < \theta < 60$				
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$			$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$		
0.10–0.13	0.115	44.6	39.40 ± 5.26	±	3.14					
0.13–0.16	0.143	44.3	28.53 ± 4.16	±	1.77	0.145	55.1	27.42 ± 4.10	±	1.83
0.16–0.20	0.179	44.5	34.81 ± 3.86	±	1.85	0.181	54.5	29.30 ± 3.62	±	1.55
0.20–0.24	0.221	44.6	39.98 ± 4.29	±	1.86	0.219	54.9	25.01 ± 3.31	±	1.15
0.24–0.30	0.268	45.2	40.81 ± 3.46	±	1.64	0.269	54.8	22.96 ± 2.53	±	0.92
0.30–0.36	0.327	44.7	25.51 ± 2.67	±	0.95	0.323	54.6	17.23 ± 2.18	±	0.66
0.36–0.42	0.390	44.5	24.90 ± 2.66	±	0.96	0.386	54.4	17.75 ± 2.19	±	0.73
0.42–0.50	0.458	45.6	17.73 ± 1.88	±	0.80	0.454	54.8	10.10 ± 1.38	±	0.52
0.50–0.60	0.543	44.2	12.43 ± 1.44	±	0.67	0.537	54.7	6.69 ± 1.07	±	0.38
0.60–0.72	0.653	45.0	5.01 ± 0.81	±	0.37	0.646	54.1	4.76 ± 0.79	±	0.36
0.72–0.90	0.782	44.7	2.22 ± 0.44	±	0.22	0.788	54.5	1.77 ± 0.40	±	0.18
0.90–1.25						1.031	54.4	0.31 ± 0.09	±	0.05

	$60 < \theta < 75$					$75 < \theta < 90$				
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$			$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$		
0.13–0.16	0.144	67.0	22.74 ± 2.98	±	1.55	0.145	81.3	16.81 ± 2.57	±	1.16
0.16–0.20	0.180	67.2	21.67 ± 2.47	±	1.15	0.181	81.8	19.17 ± 2.23	±	1.16
0.20–0.24	0.222	67.8	25.89 ± 2.72	±	1.14	0.219	81.9	17.86 ± 2.18	±	0.86
0.24–0.30	0.270	66.6	19.97 ± 1.94	±	0.78	0.270	82.1	11.28 ± 1.42	±	0.48
0.30–0.36	0.332	67.4	13.07 ± 1.53	±	0.52	0.330	82.3	10.14 ± 1.35	±	0.45
0.36–0.42	0.392	67.6	11.06 ± 1.39	±	0.50	0.385	81.6	5.06 ± 0.95	±	0.25
0.42–0.50	0.458	66.7	6.63 ± 0.94	±	0.34	0.457	80.2	3.66 ± 0.68	±	0.24
0.50–0.60	0.546	66.2	4.46 ± 0.67	±	0.29	0.544	81.2	2.43 ± 0.50	±	0.20
0.60–0.72	0.657	65.9	2.26 ± 0.44	±	0.19	0.670	82.1	0.90 ± 0.27	±	0.10
0.72–0.90	0.786	68.4	0.88 ± 0.22	±	0.10	0.809	80.4	0.60 ± 0.19	±	0.08
0.90–1.25	1.099	68.4	0.14 ± 0.05	±	0.03					

	$90 < \theta < 105$					$105 < \theta < 125$				
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$			$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$		
0.13–0.16	0.145	98.3	12.93 ± 2.18	±	1.01	0.142	113.6	11.08 ± 1.68	±	0.89
0.16–0.20	0.180	98.0	12.70 ± 1.80	±	0.79	0.177	114.1	7.89 ± 1.18	±	0.55
0.20–0.24	0.219	96.9	10.13 ± 1.60	±	0.53	0.219	115.1	6.76 ± 1.11	±	0.40
0.24–0.30	0.268	97.6	10.41 ± 1.35	±	0.49	0.271	114.2	3.84 ± 0.71	±	0.22
0.30–0.36	0.328	97.1	6.07 ± 1.01	±	0.34	0.326	114.5	3.18 ± 0.65	±	0.23
0.36–0.42	0.390	96.9	2.19 ± 0.61	±	0.15	0.394	112.0	1.75 ± 0.49	±	0.16
0.42–0.50	0.467	95.9	1.63 ± 0.47	±	0.14	0.464	112.2	0.78 ± 0.28	±	0.09
0.50–0.60	0.525	95.3	0.98 ± 0.31	±	0.11	0.539	115.2	0.24 ± 0.14	±	0.03
0.60–0.72	0.661	100.1	0.46 ± 0.21	±	0.07					

Table A.34: Double-differential inclusive cross-section $\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$ [mb/(GeV/c sr)] of the production of protons in π^- + C $\to$ p + X interactions with -12.0 GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees.

	$20 < \theta < 30$			$30 < \theta < 40$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.20–0.24	0.221	25.1	41.25 ± 1.86 ± 2.35			
0.24–0.30	0.269	25.0	42.18 ± 1.52 ± 2.22	0.269	34.9	43.08 ± 1.50 ± 2.12
0.30–0.36	0.330	24.9	37.27 ± 1.46 ± 1.93	0.327	35.0	37.66 ± 1.43 ± 1.70
0.36–0.42	0.389	25.1	33.35 ± 1.36 ± 1.62	0.388	34.9	31.42 ± 1.32 ± 1.51
0.42–0.50	0.457	24.9	29.52 ± 1.08 ± 1.35	0.457	34.9	25.58 ± 1.05 ± 1.29
0.50–0.60	0.544	25.0	24.45 ± 0.89 ± 1.10	0.545	35.0	20.79 ± 0.84 ± 1.04
0.60–0.72	0.652	25.1	18.24 ± 0.68 ± 0.89	0.650	34.8	14.78 ± 0.65 ± 0.80
0.72–0.90				0.794	34.8	9.46 ± 0.41 ± 0.60

	$40 < \theta < 50$			$50 < \theta < 60$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.30–0.36	0.331	45.0	35.82 ± 1.35 ± 1.50			
0.36–0.42	0.391	45.0	32.68 ± 1.29 ± 1.39	0.391	54.8	28.99 ± 1.21 ± 1.16
0.42–0.50	0.461	45.1	25.82 ± 1.05 ± 1.13	0.460	54.9	25.28 ± 1.00 ± 1.03
0.50–0.60	0.550	45.2	18.81 ± 0.82 ± 1.02	0.550	55.1	16.79 ± 0.78 ± 0.96
0.60–0.72	0.658	45.1	13.70 ± 0.65 ± 0.83	0.661	55.2	11.09 ± 0.60 ± 0.75
0.72–0.90	0.805	44.9	7.62 ± 0.40 ± 0.56	0.802	55.0	6.22 ± 0.37 ± 0.52
0.90–1.25	1.049	44.9	2.44 ± 0.16 ± 0.26	1.044	55.1	1.70 ± 0.15 ± 0.22

	$60 < \theta < 75$			$75 < \theta < 90$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.42–0.50	0.457	67.2	24.54 ± 0.78 ± 0.99	0.457	82.3	19.93 ± 0.70 ± 0.90
0.50–0.60	0.548	67.1	15.63 ± 0.60 ± 0.86	0.545	82.1	13.00 ± 0.54 ± 0.73
0.60–0.72	0.652	67.3	7.55 ± 0.42 ± 0.70	0.652	81.7	5.28 ± 0.36 ± 0.62
0.72–0.90	0.802	66.7	3.63 ± 0.25 ± 0.46	0.794	81.7	2.15 ± 0.20 ± 0.31

	$90 < \theta < 105$			$105 < \theta < 125$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.42–0.50	0.457	96.8	12.81 ± 0.56 ± 0.75	0.458	113.0	6.63 ± 0.36 ± 0.38
0.50–0.60	0.545	96.9	7.10 ± 0.39 ± 0.50	0.545	112.8	2.82 ± 0.24 ± 0.29
0.60–0.72	0.650	96.2	2.72 ± 0.27 ± 0.36			

Table A.35: Double-differential inclusive cross-section $\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$ [mb/(GeV/c sr)] of the production of π^+'s in π^- + C $\to \pi^+$ + X interactions with -12.0 GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees.

	$20 < \theta < 30$					$30 < \theta < 40$				
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$			$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$		
0.10–0.13	0.116	24.6	53.92 ± 2.79	±	3.82	0.116	34.7	38.45 ± 2.28	±	2.90
0.13–0.16	0.146	24.4	73.03 ± 3.05	±	4.38	0.145	34.7	46.16 ± 2.41	±	2.80
0.16–0.20	0.179	24.6	77.96 ± 2.60	±	4.02	0.180	34.9	51.53 ± 2.10	±	2.69
0.20–0.24	0.219	24.6	81.94 ± 2.62	±	3.80	0.220	34.6	56.23 ± 2.18	±	2.62
0.24–0.30	0.268	24.7	79.74 ± 2.10	±	3.28	0.268	34.6	50.64 ± 1.67	±	2.08
0.30–0.36	0.329	24.5	69.28 ± 1.94	±	2.63	0.328	34.6	45.57 ± 1.56	±	1.73
0.36–0.42	0.387	24.6	57.36 ± 1.77	±	2.17	0.387	34.7	34.98 ± 1.38	±	1.31
0.42–0.50	0.456	24.7	40.39 ± 1.24	±	1.72	0.458	34.4	29.30 ± 1.08	±	1.19
0.50–0.60	0.543	24.6	27.36 ± 0.90	±	1.51	0.542	35.0	18.37 ± 0.73	±	0.94
0.60–0.72	0.648	24.8	14.43 ± 0.55	±	1.13	0.652	34.6	9.80 ± 0.47	±	0.70
0.72–0.90						0.791	34.6	4.82 ± 0.24	±	0.53

	$40 < \theta < 50$					$50 < \theta < 60$				
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$			$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$		
0.10–0.13	0.116	44.8	26.14 ± 1.88	±	2.08					
0.13–0.16	0.146	44.6	37.29 ± 2.12	±	2.32	0.146	54.7	29.84 ± 1.89	±	1.98
0.16–0.20	0.181	45.0	38.53 ± 1.82	±	2.06	0.179	54.6	30.30 ± 1.61	±	1.64
0.20–0.24	0.220	44.7	38.72 ± 1.85	±	1.84	0.220	54.6	28.61 ± 1.57	±	1.37
0.24–0.30	0.270	44.9	37.78 ± 1.45	±	1.57	0.270	54.9	23.99 ± 1.13	±	1.01
0.30–0.36	0.329	44.6	30.95 ± 1.28	±	1.20	0.329	54.7	21.03 ± 1.05	±	0.84
0.36–0.42	0.390	44.9	24.39 ± 1.12	±	0.96	0.391	54.8	17.80 ± 0.98	±	0.73
0.42–0.50	0.459	44.7	18.40 ± 0.85	±	0.77	0.459	54.5	11.47 ± 0.65	±	0.54
0.50–0.60	0.547	44.5	11.96 ± 0.59	±	0.63	0.551	54.9	8.75 ± 0.50	±	0.50
0.60–0.72	0.655	44.4	6.80 ± 0.41	±	0.46	0.659	54.4	4.47 ± 0.32	±	0.33
0.72–0.90	0.800	44.7	3.11 ± 0.21	±	0.30	0.803	54.5	1.96 ± 0.16	±	0.20
0.90–1.25						1.030	55.0	0.45 ± 0.05	±	0.07

	$60 < \theta < 75$					$75 < \theta < 90$				
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$			$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$		
0.13–0.16	0.146	66.7	19.56 ± 1.21	±	1.38	0.145	82.1	15.61 ± 1.07	±	1.16
0.16–0.20	0.180	67.0	21.82 ± 1.07	±	1.23	0.180	81.9	17.54 ± 0.96	±	1.01
0.20–0.24	0.220	66.9	22.01 ± 1.10	±	1.03	0.219	82.0	15.74 ± 0.88	±	0.81
0.24–0.30	0.269	67.1	15.94 ± 0.76	±	0.66	0.268	82.2	11.08 ± 0.61	±	0.48
0.30–0.36	0.328	67.0	13.22 ± 0.67	±	0.54	0.328	82.0	8.18 ± 0.52	±	0.39
0.36–0.42	0.390	66.9	10.01 ± 0.57	±	0.47	0.390	81.3	6.22 ± 0.45	±	0.33
0.42–0.50	0.459	66.8	7.30 ± 0.43	±	0.37	0.458	81.4	4.00 ± 0.32	±	0.24
0.50–0.60	0.548	66.5	5.77 ± 0.35	±	0.36	0.544	81.9	2.51 ± 0.22	±	0.20
0.60–0.72	0.652	65.9	2.30 ± 0.18	±	0.21	0.659	81.7	0.92 ± 0.11	±	0.10
0.72–0.90	0.796	66.0	0.79 ± 0.08	±	0.10	0.784	81.4	0.50 ± 0.07	±	0.07
0.90–1.25	1.026	66.1	0.16 ± 0.02	±	0.03	1.024	80.8	0.06 ± 0.02	±	0.02

	$90 < \theta < 105$					$105 < \theta < 125$				
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$			$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$		
0.13–0.16	0.146	97.1	13.51 ± 0.93	±	1.17	0.145	115.1	10.51 ± 0.69	±	0.89
0.16–0.20	0.179	96.9	11.72 ± 0.74	±	0.79	0.179	114.9	8.02 ± 0.51	±	0.58
0.20–0.24	0.220	97.3	13.31 ± 0.81	±	0.70	0.219	114.2	7.03 ± 0.51	±	0.40
0.24–0.30	0.267	97.0	7.69 ± 0.50	±	0.38	0.267	114.2	5.49 ± 0.38	±	0.29
0.30–0.36	0.328	97.1	4.71 ± 0.39	±	0.27	0.328	114.1	2.94 ± 0.27	±	0.21
0.36–0.42	0.390	96.6	3.90 ± 0.37	±	0.25	0.389	113.6	1.94 ± 0.23	±	0.17
0.42–0.50	0.459	96.6	2.07 ± 0.22	±	0.18	0.457	113.3	0.89 ± 0.13	±	0.10
0.50–0.60	0.553	96.7	1.03 ± 0.13	±	0.12	0.540	114.2	0.38 ± 0.08	±	0.06
0.60–0.72	0.650	94.7	0.47 ± 0.09	±	0.07	0.641	109.8	0.10 ± 0.04	±	0.02
0.72–0.90	0.816	97.3	0.19 ± 0.05	±	0.04					
0.90–1.25	1.033	97.0	0.02 ± 0.01	±	0.01					

Table A.36: Double-differential inclusive cross-section $\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$ [mb/(GeV/c sr)] of the production of π^-'s in π^- + C $\to \pi^-$ + X interactions with -12.0 GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees.

	$20 < \theta < 30$					$30 < \theta < 40$				
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$			$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$		
0.10–0.13	0.116	24.6	80.98 ± 3.48	±	5.85	0.116	34.9	48.16 ± 2.54	±	3.68
0.13–0.16	0.145	24.8	97.58 ± 3.59	±	5.88	0.145	34.9	63.92 ± 2.85	±	3.90
0.16–0.20	0.180	24.7	110.68 ± 3.14	±	5.69	0.180	34.7	70.95 ± 2.47	±	3.71
0.20–0.24	0.220	24.6	113.04 ± 3.13	±	5.13	0.221	34.6	70.27 ± 2.44	±	3.23
0.24–0.30	0.270	24.8	110.78 ± 2.53	±	4.40	0.270	34.6	70.63 ± 1.99	±	2.84
0.30–0.36	0.330	24.7	88.88 ± 2.23	±	3.26	0.330	34.5	59.22 ± 1.81	±	2.19
0.36–0.42	0.390	24.5	78.81 ± 2.13	±	3.00	0.391	34.8	48.92 ± 1.65	±	1.83
0.42–0.50	0.460	24.7	57.95 ± 1.57	±	2.41	0.460	34.8	35.06 ± 1.22	±	1.45
0.50–0.60	0.549	24.6	40.45 ± 1.18	±	2.13	0.550	34.7	24.92 ± 0.91	±	1.28
0.60–0.72	0.657	24.6	23.76 ± 0.81	±	1.63	0.659	34.8	16.13 ± 0.67	±	1.08
0.72–0.90						0.801	34.6	7.39 ± 0.37	±	0.67

	$40 < \theta < 50$					$50 < \theta < 60$				
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$			$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$		
0.10–0.13	0.117	44.8	37.21 ± 2.22	±	3.01					
0.13–0.16	0.145	45.0	45.91 ± 2.36	±	2.88	0.145	54.7	36.87 ± 2.04	±	2.55
0.16–0.20	0.180	44.7	48.83 ± 2.07	±	2.59	0.179	55.0	37.77 ± 1.80	±	2.04
0.20–0.24	0.219	44.6	48.83 ± 2.05	±	2.30	0.219	54.7	39.56 ± 1.85	±	1.86
0.24–0.30	0.268	44.7	46.35 ± 1.60	±	1.89	0.268	54.8	32.36 ± 1.34	±	1.33
0.30–0.36	0.328	44.7	41.34 ± 1.51	±	1.56	0.328	54.7	24.65 ± 1.14	±	0.96
0.36–0.42	0.387	44.7	32.20 ± 1.31	±	1.26	0.386	54.5	20.55 ± 1.05	±	0.84
0.42–0.50	0.454	44.6	24.72 ± 0.99	±	1.08	0.456	54.4	15.62 ± 0.79	±	0.72
0.50–0.60	0.544	44.7	16.26 ± 0.73	±	0.88	0.544	54.5	11.31 ± 0.61	±	0.64
0.60–0.72	0.645	44.3	9.55 ± 0.52	±	0.68	0.651	54.7	6.57 ± 0.42	±	0.49
0.72–0.90	0.792	44.5	4.54 ± 0.28	±	0.44	0.791	54.6	2.75 ± 0.22	±	0.28
0.90–1.25						1.016	54.0	0.42 ± 0.05	±	0.07

	$60 < \theta < 75$					$75 < \theta < 90$				
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$			$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$		
0.13–0.16	0.146	67.4	26.03 ± 1.44	±	1.68	0.145	82.4	19.04 ± 1.17	±	1.43
0.16–0.20	0.180	67.1	28.09 ± 1.22	±	1.52	0.179	82.0	21.93 ± 1.07	±	1.25
0.20–0.24	0.220	67.2	24.36 ± 1.14	±	1.12	0.220	82.3	19.13 ± 1.01	±	0.89
0.24–0.30	0.269	67.0	20.74 ± 0.87	±	0.82	0.267	82.4	15.07 ± 0.74	±	0.61
0.30–0.36	0.330	66.8	17.02 ± 0.77	±	0.67	0.329	82.0	10.48 ± 0.59	±	0.47
0.36–0.42	0.388	66.6	13.64 ± 0.69	±	0.59	0.388	82.5	8.73 ± 0.55	±	0.44
0.42–0.50	0.458	66.7	9.99 ± 0.51	±	0.50	0.458	82.0	5.80 ± 0.40	±	0.35
0.50–0.60	0.548	67.1	6.91 ± 0.39	±	0.43	0.548	81.7	3.50 ± 0.28	±	0.28
0.60–0.72	0.650	66.7	3.70 ± 0.26	±	0.31	0.650	81.5	1.47 ± 0.15	±	0.16
0.72–0.90	0.790	66.6	1.28 ± 0.11	±	0.15	0.790	81.3	0.54 ± 0.07	±	0.08
0.90–1.25	1.014	67.3	0.32 ± 0.04	±	0.06	1.033	81.4	0.08 ± 0.02	±	0.02

	$90 < \theta < 105$					$105 < \theta < 125$				
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$			$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$		
0.13–0.16	0.145	97.4	16.39 ± 1.04	±	1.38	0.145	114.7	14.38 ± 0.84	±	1.11
0.16–0.20	0.179	97.2	17.35 ± 0.94	±	1.04	0.179	114.4	14.13 ± 0.73	±	0.79
0.20–0.24	0.220	96.8	12.43 ± 0.79	±	0.65	0.218	113.9	9.93 ± 0.63	±	0.48
0.24–0.30	0.267	97.0	9.87 ± 0.60	±	0.43	0.266	114.0	5.82 ± 0.40	±	0.31
0.30–0.36	0.327	96.8	6.33 ± 0.48	±	0.33	0.328	114.3	3.50 ± 0.30	±	0.26
0.36–0.42	0.387	97.3	5.23 ± 0.43	±	0.35	0.386	112.9	2.40 ± 0.24	±	0.24
0.42–0.50	0.458	96.4	2.67 ± 0.26	±	0.23	0.455	112.7	1.46 ± 0.17	±	0.18
0.50–0.60	0.544	96.7	1.81 ± 0.19	±	0.21	0.539	111.6	0.44 ± 0.08	±	0.07
0.60–0.72	0.649	96.4	0.70 ± 0.10	±	0.11	0.654	111.4	0.20 ± 0.05	±	0.04
0.72–0.90	0.787	95.0	0.18 ± 0.05	±	0.04	0.764	107.7	0.06 ± 0.02	±	0.02
0.90–1.25	0.950	98.3	0.03 ± 0.02	±	0.01					

Table A.37: Double-differential inclusive cross-section $\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$ [mb/(GeV/c sr)] of the production of protons in p + C $\rightarrow$ p + X interactions with $+15.0$ GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees.

	$20 < \theta < 30$			$30 < \theta < 40$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.20–0.24	0.221	24.8	55.34 $\pm$ 2.59 $\pm$ 3.11			
0.24–0.30	0.271	25.1	63.34 $\pm$ 2.26 $\pm$ 3.30	0.271	34.9	58.41 $\pm$ 2.12 $\pm$ 2.84
0.30–0.36	0.332	24.9	53.01 $\pm$ 2.07 $\pm$ 2.73	0.332	35.0	56.68 $\pm$ 2.12 $\pm$ 2.52
0.36–0.42	0.392	25.0	48.98 $\pm$ 1.98 $\pm$ 2.35	0.392	34.8	49.91 $\pm$ 2.01 $\pm$ 2.37
0.42–0.50	0.463	25.1	43.07 $\pm$ 1.60 $\pm$ 1.91	0.463	35.1	40.24 $\pm$ 1.59 $\pm$ 1.83
0.50–0.60	0.553	25.0	37.69 $\pm$ 1.32 $\pm$ 1.66	0.555	34.9	32.63 $\pm$ 1.28 $\pm$ 1.56
0.60–0.72	0.665	25.0	31.53 $\pm$ 1.09 $\pm$ 1.51	0.665	34.7	23.41 $\pm$ 0.97 $\pm$ 1.24
0.72–0.90				0.815	34.7	15.70 $\pm$ 0.66 $\pm$ 1.01

	$40 < \theta < 50$			$50 < \theta < 60$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.30–0.36	0.330	45.1	54.04 $\pm$ 2.00 $\pm$ 2.26			
0.36–0.42	0.389	45.0	50.89 $\pm$ 1.99 $\pm$ 1.98	0.391	55.0	50.13 $\pm$ 1.90 $\pm$ 2.05
0.42–0.50	0.458	45.0	37.65 $\pm$ 1.51 $\pm$ 1.72	0.458	54.8	38.94 $\pm$ 1.50 $\pm$ 1.55
0.50–0.60	0.545	44.9	30.11 $\pm$ 1.26 $\pm$ 1.58	0.548	54.9	25.28 $\pm$ 1.14 $\pm$ 1.40
0.60–0.72	0.654	45.0	22.64 $\pm$ 1.02 $\pm$ 1.31	0.654	54.9	17.31 $\pm$ 0.90 $\pm$ 1.09
0.72–0.90	0.799	45.0	11.64 $\pm$ 0.59 $\pm$ 0.83	0.797	54.7	9.44 $\pm$ 0.54 $\pm$ 0.75
0.90–1.25	1.042	44.7	3.75 $\pm$ 0.24 $\pm$ 0.39	1.035	54.9	2.58 $\pm$ 0.21 $\pm$ 0.32

	$60 < \theta < 75$			$75 < \theta < 90$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.42–0.50	0.458	67.1	38.51 $\pm$ 1.19 $\pm$ 1.50	0.458	82.4	29.30 $\pm$ 1.03 $\pm$ 1.31
0.50–0.60	0.546	67.3	24.85 $\pm$ 0.91 $\pm$ 1.25	0.546	81.8	16.87 $\pm$ 0.72 $\pm$ 0.95
0.60–0.72	0.653	67.2	13.69 $\pm$ 0.68 $\pm$ 1.19	0.652	81.7	7.44 $\pm$ 0.52 $\pm$ 0.80
0.72–0.90	0.797	66.7	5.36 $\pm$ 0.36 $\pm$ 0.65	0.793	82.1	2.79 $\pm$ 0.27 $\pm$ 0.38

	$90 < \theta < 105$			$105 < \theta < 125$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.42–0.50	0.458	96.5	19.19 $\pm$ 0.84 $\pm$ 1.11	0.456	113.4	7.81 $\pm$ 0.47 $\pm$ 0.45
0.50–0.60	0.541	96.6	10.91 $\pm$ 0.59 $\pm$ 0.76	0.541	112.1	4.02 $\pm$ 0.34 $\pm$ 0.39
0.60–0.72	0.653	96.6	3.47 $\pm$ 0.36 $\pm$ 0.44	0.655	111.9	1.29 $\pm$ 0.20 $\pm$ 0.22
0.72–0.90	0.798	95.5	1.19 $\pm$ 0.18 $\pm$ 0.18	0.794	111.8	0.41 $\pm$ 0.09 $\pm$ 0.09
0.90–1.25				1.074	113.1	0.10 $\pm$ 0.04 $\pm$ 0.04

Table A.38: Double-differential inclusive cross-section $\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$ [mb/(GeV/c sr)] of the production of π^+'s in p + C $\to \pi^+$ + X interactions with $+15.0$ GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees.

	$20 < \theta < 30$			$30 < \theta < 40$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.10–0.13	0.116	24.7	82.76 ± 4.65 ± 6.17	0.116	34.8	56.38 ± 3.67 ± 4.23
0.13–0.16	0.145	24.5	100.59 ± 4.56 ± 6.01	0.145	34.9	72.10 ± 3.88 ± 4.31
0.16–0.20	0.181	24.7	115.25 ± 4.06 ± 5.90	0.181	35.0	86.43 ± 3.56 ± 4.50
0.20–0.24	0.221	24.7	121.75 ± 4.06 ± 5.57	0.222	34.6	83.13 ± 3.35 ± 3.83
0.24–0.30	0.270	24.7	111.23 ± 3.17 ± 4.51	0.272	34.7	73.21 ± 2.55 ± 2.97
0.30–0.36	0.332	24.7	101.66 ± 2.97 ± 3.81	0.332	34.6	66.76 ± 2.44 ± 2.51
0.36–0.42	0.391	24.7	78.53 ± 2.64 ± 2.99	0.392	34.8	51.67 ± 2.10 ± 1.93
0.42–0.50	0.461	24.7	58.24 ± 1.94 ± 2.46	0.461	34.7	39.38 ± 1.61 ± 1.60
0.50–0.60	0.554	24.6	39.07 ± 1.39 ± 2.15	0.552	34.7	27.65 ± 1.16 ± 1.41
0.60–0.72	0.660	24.6	23.60 ± 0.95 ± 1.84	0.662	34.5	15.09 ± 0.77 ± 1.07
0.72–0.90				0.803	34.4	7.58 ± 0.41 ± 0.82

	$40 < \theta < 50$			$50 < \theta < 60$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.10–0.13	0.116	44.5	47.45 ± 3.47 ± 3.70			
0.13–0.16	0.144	45.0	52.01 ± 3.17 ± 3.19	0.146	54.9	44.23 ± 2.89 ± 2.88
0.16–0.20	0.180	44.6	56.10 ± 2.75 ± 2.95	0.181	54.9	44.17 ± 2.48 ± 2.33
0.20–0.24	0.220	44.6	58.18 ± 2.86 ± 2.72	0.220	54.9	47.46 ± 2.57 ± 2.23
0.24–0.30	0.271	44.9	51.86 ± 2.13 ± 2.14	0.268	54.7	37.15 ± 1.80 ± 1.54
0.30–0.36	0.329	44.6	44.59 ± 1.99 ± 1.72	0.327	55.1	30.08 ± 1.62 ± 1.19
0.36–0.42	0.389	44.7	35.70 ± 1.74 ± 1.41	0.388	54.7	22.97 ± 1.39 ± 0.96
0.42–0.50	0.457	44.7	22.44 ± 1.17 ± 0.98	0.457	54.8	16.86 ± 1.03 ± 0.76
0.50–0.60	0.546	44.5	18.65 ± 1.00 ± 0.94	0.545	54.7	10.65 ± 0.73 ± 0.58
0.60–0.72	0.657	44.5	9.46 ± 0.62 ± 0.63	0.654	54.8	6.48 ± 0.53 ± 0.46
0.72–0.90	0.797	44.3	4.68 ± 0.34 ± 0.46	0.786	54.3	2.51 ± 0.24 ± 0.26
0.90–1.25				1.013	54.8	0.64 ± 0.07 ± 0.11

	$60 < \theta < 75$			$75 < \theta < 90$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.13–0.16	0.146	67.3	25.42 ± 1.82 ± 1.64	0.145	82.8	24.99 ± 1.73 ± 1.79
0.16–0.20	0.180	67.1	33.59 ± 1.68 ± 1.85	0.180	82.5	24.52 ± 1.40 ± 1.45
0.20–0.24	0.219	67.1	33.04 ± 1.69 ± 1.52	0.220	82.3	21.75 ± 1.32 ± 1.06
0.24–0.30	0.269	67.1	26.39 ± 1.23 ± 1.07	0.267	82.2	17.93 ± 1.01 ± 0.74
0.30–0.36	0.328	67.0	18.03 ± 1.01 ± 0.71	0.326	81.9	11.71 ± 0.81 ± 0.51
0.36–0.42	0.389	66.7	13.92 ± 0.88 ± 0.60	0.388	82.3	7.78 ± 0.65 ± 0.41
0.42–0.50	0.458	66.8	10.26 ± 0.65 ± 0.51	0.457	81.4	6.71 ± 0.54 ± 0.40
0.50–0.60	0.544	66.3	6.51 ± 0.47 ± 0.41	0.541	81.9	3.36 ± 0.32 ± 0.28
0.60–0.72	0.653	66.2	3.20 ± 0.29 ± 0.27	0.654	81.7	1.41 ± 0.19 ± 0.15
0.72–0.90	0.797	66.2	1.13 ± 0.13 ± 0.14	0.778	81.1	0.50 ± 0.09 ± 0.07
0.90–1.25	1.031	66.4	0.23 ± 0.03 ± 0.04	1.008	82.0	0.05 ± 0.02 ± 0.02

	$90 < \theta < 105$			$105 < \theta < 125$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.13–0.16	0.145	96.7	20.50 ± 1.52 ± 1.58	0.144	114.4	17.03 ± 1.17 ± 1.33
0.16–0.20	0.179	97.3	20.12 ± 1.22 ± 1.34	0.179	114.0	15.47 ± 0.94 ± 0.92
0.20–0.24	0.219	97.0	16.71 ± 1.16 ± 0.83	0.220	114.0	9.57 ± 0.75 ± 0.55
0.24–0.30	0.266	97.0	12.17 ± 0.83 ± 0.54	0.266	113.0	6.05 ± 0.50 ± 0.33
0.30–0.36	0.327	97.5	7.71 ± 0.65 ± 0.42	0.326	113.1	4.03 ± 0.41 ± 0.28
0.36–0.42	0.386	96.8	5.53 ± 0.56 ± 0.38	0.387	114.6	1.69 ± 0.25 ± 0.16
0.42–0.50	0.456	96.6	3.34 ± 0.37 ± 0.29	0.453	111.8	1.08 ± 0.18 ± 0.13
0.50–0.60	0.544	95.7	0.97 ± 0.17 ± 0.11	0.544	113.2	0.60 ± 0.13 ± 0.09
0.60–0.72	0.663	96.0	0.56 ± 0.12 ± 0.08	0.646	111.6	0.05 ± 0.03 ± 0.02
0.72–0.90	0.773	96.4	0.13 ± 0.05 ± 0.03	0.771	112.0	0.03 ± 0.02 ± 0.01

Table A.39: Double-differential inclusive cross-section $\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$ [mb/(GeV/c sr)] of the production of π^-'s in p + C $\to \pi^-$ + X interactions with $+15.0$ GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees.

	$20 < \theta < 30$					$30 < \theta < 40$				
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$			$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$		
0.10–0.13	0.115	24.4	75.19 ± 4.21	±	5.41	0.116	34.9	47.10 ± 3.29	±	3.65
0.13–0.16	0.144	24.6	96.67 ± 4.31	±	5.77	0.145	34.7	62.79 ± 3.48	±	3.88
0.16–0.20	0.179	24.6	107.94 ± 3.87	±	5.54	0.179	34.5	74.17 ± 3.13	±	3.90
0.20–0.24	0.220	24.6	112.56 ± 3.87	±	5.09	0.220	34.6	76.43 ± 3.18	±	3.53
0.24–0.30	0.268	24.6	99.97 ± 2.94	±	3.94	0.267	34.6	64.50 ± 2.35	±	2.58
0.30–0.36	0.327	24.8	87.02 ± 2.80	±	3.17	0.328	34.5	57.87 ± 2.23	±	2.15
0.36–0.42	0.386	24.9	65.91 ± 2.38	±	2.45	0.386	34.7	45.57 ± 1.98	±	1.72
0.42–0.50	0.453	24.7	52.82 ± 1.85	±	2.21	0.451	34.5	34.13 ± 1.47	±	1.43
0.50–0.60	0.540	24.7	33.06 ± 1.32	±	1.73	0.540	34.8	20.60 ± 1.03	±	1.08
0.60–0.72	0.643	24.9	17.91 ± 0.87	±	1.24	0.645	34.7	12.85 ± 0.73	±	0.88
0.72–0.90						0.785	34.6	5.32 ± 0.37	±	0.50

	$40 < \theta < 50$					$50 < \theta < 60$				
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$			$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$		
0.10–0.13	0.115	45.0	41.43 ± 3.05	±	3.36					
0.13–0.16	0.145	44.8	39.44 ± 2.68	±	2.53	0.146	55.1	32.57 ± 2.30	±	2.49
0.16–0.20	0.180	44.9	52.32 ± 2.66	±	2.82	0.180	54.9	35.54 ± 2.13	±	1.96
0.20–0.24	0.220	44.8	51.63 ± 2.63	±	2.45	0.220	54.7	41.72 ± 2.33	±	2.01
0.24–0.30	0.269	44.7	45.91 ± 1.99	±	1.88	0.270	54.9	31.44 ± 1.64	±	1.31
0.30–0.36	0.330	44.7	38.48 ± 1.74	±	1.58	0.330	54.3	25.25 ± 1.43	±	1.01
0.36–0.42	0.388	44.9	30.10 ± 1.60	±	1.21	0.389	54.8	21.95 ± 1.34	±	0.95
0.42–0.50	0.458	44.8	20.55 ± 1.12	±	0.93	0.458	54.5	13.19 ± 0.85	±	0.72
0.50–0.60	0.546	44.8	13.66 ± 0.79	±	0.80	0.549	54.4	9.79 ± 0.70	±	0.57
0.60–0.72	0.651	44.8	8.15 ± 0.57	±	0.60	0.652	54.5	5.25 ± 0.47	±	0.40
0.72–0.90	0.789	44.3	3.75 ± 0.31	±	0.38	0.796	54.7	1.83 ± 0.20	±	0.21
0.90–1.25						1.026	54.2	0.56 ± 0.07	±	0.09

	$60 < \theta < 75$					$75 < \theta < 90$				
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$			$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$		
0.13–0.16	0.146	67.7	31.06 ± 1.95	±	2.08	0.145	82.5	21.91 ± 1.56	±	1.73
0.16–0.20	0.179	67.4	27.57 ± 1.51	±	1.51	0.179	82.2	20.29 ± 1.23	±	1.32
0.20–0.24	0.220	66.7	28.11 ± 1.50	±	1.35	0.218	82.6	19.00 ± 1.21	±	1.01
0.24–0.30	0.269	67.0	21.98 ± 1.10	±	0.89	0.267	81.8	13.59 ± 0.84	±	0.63
0.30–0.36	0.329	66.7	16.97 ± 0.91	±	0.81	0.331	82.0	10.21 ± 0.73	±	0.48
0.36–0.42	0.389	66.3	11.78 ± 0.75	±	0.64	0.389	81.9	8.26 ± 0.63	±	0.51
0.42–0.50	0.455	67.1	9.62 ± 0.62	±	0.50	0.457	81.2	5.38 ± 0.46	±	0.37
0.50–0.60	0.544	66.5	6.00 ± 0.42	±	0.42	0.542	81.7	3.29 ± 0.31	±	0.30
0.60–0.72	0.654	66.2	2.86 ± 0.26	±	0.26	0.652	80.9	1.16 ± 0.16	±	0.14
0.72–0.90	0.788	66.0	1.16 ± 0.14	±	0.13	0.814	80.4	0.52 ± 0.09	±	0.08
0.90–1.25	1.023	66.6	0.24 ± 0.04	±	0.05	1.059	80.0	0.07 ± 0.02	±	0.02

	$90 < \theta < 105$					$105 < \theta < 125$				
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$			$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$		
0.13–0.16	0.146	97.5	16.64 ± 1.29	±	1.48	0.146	114.4	13.63 ± 1.02	±	1.11
0.16–0.20	0.180	97.5	15.73 ± 1.07	±	1.08	0.178	114.5	11.24 ± 0.75	±	0.83
0.20–0.24	0.220	97.1	13.84 ± 0.99	±	0.85	0.218	114.2	8.81 ± 0.67	±	0.59
0.24–0.30	0.268	97.0	10.44 ± 0.74	±	0.50	0.267	113.6	4.93 ± 0.43	±	0.33
0.30–0.36	0.331	97.2	5.46 ± 0.52	±	0.34	0.328	113.4	3.08 ± 0.35	±	0.24
0.36–0.42	0.389	97.2	4.79 ± 0.50	±	0.35	0.392	113.5	1.85 ± 0.26	±	0.19
0.42–0.50	0.458	96.4	2.69 ± 0.32	±	0.25	0.458	114.2	0.86 ± 0.15	±	0.11
0.50–0.60	0.548	96.5	1.65 ± 0.23	±	0.20	0.549	112.6	0.35 ± 0.09	±	0.06
0.60–0.72	0.646	96.2	0.61 ± 0.12	±	0.09	0.635	110.3	0.39 ± 0.10	±	0.08
0.72–0.90	0.761	96.6	0.12 ± 0.05	±	0.03					
0.90–1.25	1.019	96.5	0.07 ± 0.03	±	0.02					

Table A.40: Double-differential inclusive cross-section $\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$ [mb/(GeV/c sr)] of the production of protons in π^+ + C $\to$ p + X interactions with $+15.0$ GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees.

	$20 < \theta < 30$					$30 < \theta < 40$				
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$			$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$		
0.24–0.30	0.277	24.6	58.07 ± 19.32	±	3.45	0.270	34.7	48.15 ± 17.20	±	2.69
0.30–0.36	0.332	24.5	44.31 ± 17.21	±	2.62	0.319	32.7	47.22 ± 17.02	±	2.49
0.36–0.42	0.396	25.7	56.76 ± 19.68	±	3.18	0.400	34.7	39.77 ± 15.68	±	2.21
0.42–0.50	0.456	25.5	64.62 ± 17.67	±	3.41	0.473	35.9	21.50 ± 10.77	±	1.15
0.50–0.60	0.575	22.1	7.48 ± 4.13	±	0.39	0.555	33.1	10.92 ± 6.28	±	0.61
0.60–0.72	0.647	25.4	32.19 ± 10.14	±	1.80	0.647	35.9	17.06 ± 7.73	±	1.03
0.72–0.90						0.827	36.3	9.34 ± 4.58	±	0.66

	$40 < \theta < 50$					$50 < \theta < 60$				
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$			$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$		
0.30–0.36	0.322	43.9	24.31 ± 12.24	±	1.22					
0.36–0.42	0.386	43.9	47.07 ± 17.41	±	2.27	0.390	55.1	65.25 ± 19.84	±	3.23
0.42–0.50	0.466	44.7	14.41 ± 8.16	±	0.78	0.461	55.5	30.66 ± 12.26	±	1.50
0.50–0.60	0.534	47.4	13.48 ± 7.90	±	0.80	0.537	55.6	18.57 ± 8.94	±	1.14
0.60–0.72	0.674	43.9	7.18 ± 5.00	±	0.46	0.645	53.9	16.29 ± 7.97	±	1.12
0.72–0.90	0.795	43.3	4.60 ± 3.22	±	0.35	0.784	55.2	9.59 ± 4.96	±	0.80
0.90–1.25	1.053	41.6	3.07 ± 1.71	±	0.33	1.061	53.5	2.87 ± 2.07	±	0.37

	$60 < \theta < 75$					$75 < \theta < 90$				
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$			$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$		
0.42–0.50	0.453	67.9	35.42 ± 10.50	±	1.69	0.460	82.7	30.25 ± 9.62	±	1.58
0.50–0.60	0.559	67.0	13.92 ± 6.14	±	0.79	0.545	81.2	20.53 ± 7.25	±	1.27
0.60–0.72	0.628	65.4	8.01 ± 4.67	±	0.69	0.655	81.7	10.40 ± 5.30	±	1.04
0.72–0.90	0.815	67.0	6.78 ± 3.70	±	0.82					

	$90 < \theta < 105$					$105 < \theta < 125$				
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$			$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$		
0.42–0.50	0.452	98.9	9.16 ± 5.33	±	0.58	0.445	113.0	4.02 ± 2.96	±	0.25
0.50–0.60	0.541	97.4	14.39 ± 6.16	±	1.07	0.557	111.1	6.74 ± 3.92	±	0.64
0.60–0.72	0.629	94.1	6.46 ± 4.29	±	0.71					

Table A.41: Double-differential inclusive cross-section $\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$ [mb/(GeV/c sr)] of the production of π^+'s in π^+ + C $\to \pi^+$ + X interactions with $+15.0$ GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees.

	$20 < \theta < 30$					$30 < \theta < 40$				
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$			$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$		
0.10–0.13	0.111	24.7	63.47 ±	45.79 ±	5.02	0.110	36.0	36.85 ±	26.52 ±	2.91
0.13–0.16	0.147	23.6	63.30 ±	32.38 ±	4.17	0.149	35.5	45.18 ±	28.76 ±	2.98
0.16–0.20	0.184	25.2	149.56 ±	44.44 ±	8.71	0.189	34.6	117.09 ±	38.49 ±	6.93
0.20–0.24	0.217	24.1	95.15 ±	31.13 ±	5.06	0.211	35.1	78.60 ±	31.55 ±	4.20
0.24–0.30	0.275	24.2	117.18 ±	29.65 ±	5.74	0.264	34.7	97.11 ±	26.75 ±	4.75
0.30–0.36	0.333	25.5	92.48 ±	26.17 ±	4.29	0.324	34.3	121.82 ±	29.45 ±	5.65
0.36–0.42	0.395	23.8	80.84 ±	24.66 ±	3.78	0.391	34.4	93.31 ±	25.41 ±	4.31
0.42–0.50	0.468	24.2	47.06 ±	14.76 ±	2.37	0.458	35.5	34.90 ±	14.82 ±	1.70
0.50–0.60	0.567	24.5	22.53 ±	9.00 ±	1.38	0.557	34.7	18.37 ±	8.57 ±	1.06
0.60–0.72	0.681	23.4	14.70 ±	6.42 ±	1.22	0.632	34.2	13.40 ±	6.97 ±	1.02
0.72–0.90						0.823	34.1	5.38 ±	3.09 ±	0.60

	$40 < \theta < 50$					$50 < \theta < 60$				
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$			$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$		
0.10–0.13	0.106	47.5	44.78 ±	31.66 ±	3.65					
0.13–0.16	0.138	46.8	67.50 ±	34.96 ±	4.54					
0.16–0.20	0.181	43.9	44.07 ±	21.90 ±	2.62	0.172	56.3	21.54 ±	15.43 ±	1.29
0.20–0.24	0.223	44.4	41.94 ±	22.13 ±	2.27	0.223	54.4	42.37 ±	21.71 ±	2.32
0.24–0.30	0.270	44.7	28.31 ±	14.53 ±	1.40	0.267	57.0	41.81 ±	17.55 ±	2.08
0.30–0.36	0.325	43.0	41.04 ±	17.24 ±	1.94	0.337	55.8	19.54 ±	11.59 ±	0.94
0.36–0.42	0.394	44.1	43.10 ±	16.86 ±	2.05	0.400	52.8	17.71 ±	10.46 ±	0.87
0.42–0.50	0.447	45.4	21.28 ±	10.34 ±	1.09	0.485	57.7	0.45 ±	0.36 ±	0.02
0.50–0.60	0.588	45.7	12.25 ±	7.31 ±	0.70	0.523	55.7	9.88 ±	7.23 ±	0.60
0.60–0.72	0.636	40.7	5.13 ±	4.19 ±	0.37	0.655	53.9	6.50 ±	4.76 ±	0.49
0.72–0.90	0.772	45.4	7.31 ±	3.99 ±	0.74					

	$60 < \theta < 75$					$75 < \theta < 90$				
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$			$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$		
0.13–0.16	0.150	62.0	19.78 ±	14.00 ±	1.40	0.138	81.1	49.32 ±	22.08 ±	3.78
0.16–0.20	0.180	68.0	37.33 ±	16.30 ±	2.29					
0.20–0.24	0.215	65.1	22.10 ±	11.93 ±	1.19	0.220	85.6	17.76 ±	10.50 ±	0.99
0.24–0.30	0.274	71.8	9.18 ±	6.54 ±	0.45	0.250	82.5	15.20 ±	8.03 ±	0.75
0.30–0.36						0.331	82.2	20.93 ±	9.72 ±	1.07
0.36–0.42	0.383	64.4	15.58 ±	7.80 ±	0.79	0.407	79.7	7.99 ±	5.75 ±	0.47
0.42–0.50	0.454	66.6	15.22 ±	7.02 ±	0.86	0.456	80.1	9.56 ±	5.70 ±	0.62
0.50–0.60	0.548	66.4	11.88 ±	5.58 ±	0.80					
0.60–0.72						0.702	87.5	2.94 ±	2.27 ±	0.31

	$90 < \theta < 105$					$105 < \theta < 125$				
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$			$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$		
0.13–0.16	0.149	95.9	49.62 ±	20.96 ±	4.05	0.145	112.7	12.32 ±	8.72 ±	1.01
0.16–0.20	0.180	97.6	26.11 ±	12.01 ±	1.88	0.179	114.8	21.11 ±	10.14 ±	1.37
0.20–0.24	0.215	93.9	12.49 ±	8.99 ±	0.71					
0.24–0.30	0.269	98.9	12.66 ±	7.54 ±	0.66	0.263	107.8	7.29 ±	5.42 ±	0.44
0.30–0.36						0.331	113.4	9.78 ±	5.46 ±	0.71
0.50–0.60	0.548	103.0	4.46 ±	3.17 ±	0.50					

Table A.42: Double-differential inclusive cross-section $\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$ [mb/(GeV/c sr)] of the production of π^-'s in π^+ + C $\to \pi^-$ + X interactions with $+15.0$ GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees.

	$20 < \theta < 30$			$30 < \theta < 40$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.10–0.13	0.111	25.4	112.65 ± 51.64 ± 8.59			
0.13–0.16	0.143	24.2	93.22 ± 39.09 ± 6.07	0.146	33.5	76.85 ± 34.93 ± 5.14
0.16–0.20	0.182	24.1	91.22 ± 30.44 ± 5.29	0.180	34.3	32.87 ± 16.81 ± 1.94
0.20–0.24	0.218	26.6	112.46 ± 36.95 ± 5.93	0.215	34.3	71.35 ± 27.40 ± 3.82
0.24–0.30	0.266	24.1	98.56 ± 25.63 ± 4.74	0.262	34.9	38.55 ± 17.41 ± 1.87
0.30–0.36	0.321	26.5	52.96 ± 20.07 ± 2.41	0.326	34.3	71.08 ± 22.63 ± 3.28
0.36–0.42	0.382	25.7	36.85 ± 16.53 ± 1.70	0.386	35.8	67.70 ± 22.73 ± 3.16
0.42–0.50	0.463	23.4	73.41 ± 20.09 ± 3.66	0.431	34.4	40.96 ± 14.56 ± 2.05
0.50–0.60	0.529	23.7	21.21 ± 9.54 ± 1.25	0.534	35.2	16.27 ± 8.14 ± 0.96
0.60–0.72	0.655	21.7	5.69 ± 4.02 ± 0.42	0.642	35.2	10.74 ± 6.25 ± 0.79
0.72–0.90				0.827	31.0	6.77 ± 3.94 ± 0.66

	$40 < \theta < 50$			$50 < \theta < 60$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.10–0.13	0.106	41.2	46.81 ± 34.68 ± 3.94			
0.13–0.16	0.142	43.8	30.23 ± 21.38 ± 2.08	0.145	55.1	69.49 ± 29.70 ± 5.52
0.16–0.20	0.176	42.9	32.52 ± 18.70 ± 1.96	0.171	55.9	23.28 ± 16.53 ± 1.42
0.20–0.24	0.224	44.6	59.57 ± 26.93 ± 3.26			
0.24–0.30	0.274	43.4	26.50 ± 13.25 ± 1.31	0.265	53.3	29.66 ± 14.91 ± 1.48
0.30–0.36	0.334	45.2	49.55 ± 17.75 ± 2.45	0.342	54.4	19.75 ± 11.65 ± 0.96
0.36–0.42	0.379	45.8	37.74 ± 17.02 ± 1.84	0.384	52.8	18.20 ± 10.51 ± 0.94
0.42–0.50	0.456	46.1	11.15 ± 7.95 ± 0.59	0.460	56.5	18.97 ± 9.55 ± 1.18
0.50–0.60	0.568	47.2	11.12 ± 6.42 ± 0.72			
0.60–0.72				0.667	55.2	10.84 ± 6.31 ± 0.89
0.72–0.90				0.859	53.4	3.31 ± 2.34 ± 0.40
0.90–1.25				0.973	56.9	1.66 ± 1.17 ± 0.29

	$60 < \theta < 75$			$75 < \theta < 90$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.13–0.16	0.146	60.5	21.07 ± 15.20 ± 1.51			
0.16–0.20	0.182	63.5	38.09 ± 15.56 ± 2.32	0.181	80.7	23.74 ± 11.88 ± 1.67
0.20–0.24	0.223	65.8	13.84 ± 9.92 ± 0.77			
0.24–0.30	0.278	68.5	29.74 ± 12.22 ± 1.45	0.267	82.2	26.02 ± 10.68 ± 1.41
0.36–0.42	0.379	65.4	11.26 ± 6.50 ± 0.69			
0.50–0.60				0.581	85.9	5.02 ± 3.57 ± 0.48

	$90 < \theta < 105$			$105 < \theta < 125$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.13–0.16	0.153	93.3	17.19 ± 10.31 ± 1.59	0.146	112.9	18.15 ± 10.48 ± 1.55
0.16–0.20	0.175	99.3	11.89 ± 8.41 ± 0.87	0.186	116.3	11.83 ± 6.83 ± 0.92
0.20–0.24	0.226	96.3	16.98 ± 9.81 ± 1.15			
0.24–0.30				0.274	115.4	6.59 ± 4.70 ± 0.47

Table A.43: Double-differential inclusive cross-section $\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$ [mb/(GeV/c sr)] of the production of protons in π^- + C $\to$ p + X interactions with -15.0 GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees.

	$20 < \theta < 30$			$30 < \theta < 40$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.20–0.24	0.221	24.8	47.48 ± 2.16 ± 2.99			
0.24–0.30	0.272	25.1	41.90 ± 1.61 ± 2.53	0.274	35.1	38.97 ± 1.53 ± 2.23
0.30–0.36	0.333	25.1	34.98 ± 1.51 ± 2.07	0.333	34.9	37.21 ± 1.51 ± 1.99
0.36–0.42	0.394	25.0	31.34 ± 1.40 ± 1.75	0.394	35.0	31.77 ± 1.45 ± 1.73
0.42–0.50	0.464	24.8	29.49 ± 1.16 ± 1.57	0.465	34.8	25.34 ± 1.10 ± 1.43
0.50–0.60	0.555	25.0	25.34 ± 0.95 ± 1.32	0.558	35.0	19.02 ± 0.85 ± 1.08
0.60–0.72	0.668	24.9	17.03 ± 0.70 ± 0.94	0.670	35.1	15.75 ± 0.71 ± 0.94
0.72–0.90				0.818	34.9	8.57 ± 0.42 ± 0.60

	$40 < \theta < 50$			$50 < \theta < 60$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.30–0.36	0.331	45.0	39.42 ± 1.51 ± 2.00			
0.36–0.42	0.392	45.0	34.37 ± 1.45 ± 1.66	0.392	54.9	33.05 ± 1.36 ± 1.68
0.42–0.50	0.460	45.0	26.89 ± 1.15 ± 1.45	0.460	54.9	26.30 ± 1.09 ± 1.30
0.50–0.60	0.548	45.1	19.64 ± 0.90 ± 1.19	0.549	55.0	16.77 ± 0.84 ± 1.07
0.60–0.72	0.660	45.0	12.35 ± 0.66 ± 0.82	0.658	54.9	11.00 ± 0.63 ± 0.76
0.72–0.90	0.801	45.0	7.25 ± 0.42 ± 0.56	0.807	55.1	5.93 ± 0.40 ± 0.52
0.90–1.25	1.053	45.1	2.26 ± 0.16 ± 0.24	1.047	54.7	1.42 ± 0.14 ± 0.19

	$60 < \theta < 75$			$75 < \theta < 90$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.42–0.50	0.455	67.3	25.66 ± 0.87 ± 1.25	0.456	81.7	19.80 ± 0.75 ± 1.06
0.50–0.60	0.544	67.3	16.87 ± 0.68 ± 1.01	0.541	82.2	12.83 ± 0.57 ± 0.80
0.60–0.72	0.650	67.1	8.32 ± 0.46 ± 0.79	0.648	82.3	4.64 ± 0.37 ± 0.55
0.72–0.90	0.791	67.0	3.58 ± 0.27 ± 0.45	0.790	81.2	1.81 ± 0.19 ± 0.26

	$90 < \theta < 105$			$105 < \theta < 125$		
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$
0.42–0.50	0.453	96.6	13.26 ± 0.63 ± 0.84	0.456	113.5	6.37 ± 0.38 ± 0.42
0.50–0.60	0.540	96.5	6.82 ± 0.41 ± 0.52	0.540	113.0	3.05 ± 0.26 ± 0.31
0.60–0.72	0.648	96.7	3.01 ± 0.30 ± 0.38	0.647	111.7	1.00 ± 0.15 ± 0.17
0.72–0.90	0.787	96.4	0.95 ± 0.14 ± 0.15			

Table A.44: Double-differential inclusive cross-section $\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$ [mb/(GeV/c sr)] of the production of π^+'s in π^- + C $\to \pi^+$ + X interactions with -15.0 GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees.

	$20 < \theta < 30$					$30 < \theta < 40$				
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$			$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$		
0.10–0.13	0.116	24.6	56.76 ± 3.09	±	4.33	0.117	35.0	36.66 ± 2.42	±	2.94
0.13–0.16	0.146	24.8	76.30 ± 3.38	±	5.04	0.146	34.7	47.91 ± 2.62	±	3.17
0.16–0.20	0.181	24.6	82.77 ± 2.90	±	4.81	0.182	34.7	56.19 ± 2.36	±	3.29
0.20–0.24	0.221	24.4	85.04 ± 2.88	±	4.55	0.222	34.7	58.98 ± 2.40	±	3.17
0.24–0.30	0.272	24.5	84.00 ± 2.30	±	4.13	0.271	34.6	56.11 ± 1.89	±	2.75
0.30–0.36	0.333	24.7	69.54 ± 2.09	±	3.24	0.332	34.6	46.49 ± 1.69	±	2.17
0.36–0.42	0.394	24.7	61.67 ± 1.98	±	2.86	0.394	34.7	37.53 ± 1.54	±	1.74
0.42–0.50	0.464	24.5	46.88 ± 1.45	±	2.35	0.464	34.7	26.60 ± 1.09	±	1.30
0.50–0.60	0.555	24.5	29.46 ± 1.00	±	1.80	0.555	34.8	17.87 ± 0.79	±	1.03
0.60–0.72	0.668	24.5	16.66 ± 0.67	±	1.37	0.669	34.6	10.44 ± 0.50	±	0.82
0.72–0.90						0.820	34.7	4.70 ± 0.27	±	0.52

	$40 < \theta < 50$					$50 < \theta < 60$				
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$			$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$		
0.10–0.13	0.116	44.4	27.22 ± 2.09	±	2.25					
0.13–0.16	0.146	44.9	34.45 ± 2.15	±	2.36	0.145	54.9	24.14 ± 1.78	±	1.80
0.16–0.20	0.181	44.8	38.73 ± 2.01	±	2.31	0.180	54.6	31.11 ± 1.74	±	1.87
0.20–0.24	0.221	44.6	38.37 ± 1.93	±	2.10	0.220	54.6	32.04 ± 1.76	±	1.76
0.24–0.30	0.270	44.7	36.33 ± 1.51	±	1.80	0.270	54.6	24.52 ± 1.23	±	1.22
0.30–0.36	0.331	44.8	31.87 ± 1.41	±	1.51	0.331	54.9	21.42 ± 1.14	±	1.03
0.36–0.42	0.389	45.1	24.79 ± 1.23	±	1.18	0.390	54.7	16.25 ± 0.97	±	0.82
0.42–0.50	0.459	44.6	16.44 ± 0.85	±	0.83	0.459	54.4	12.00 ± 0.72	±	0.66
0.50–0.60	0.548	44.4	11.20 ± 0.61	±	0.65	0.546	55.0	8.67 ± 0.55	±	0.53
0.60–0.72	0.655	44.5	6.95 ± 0.44	±	0.50	0.654	54.6	4.67 ± 0.35	±	0.37
0.72–0.90	0.792	44.4	3.05 ± 0.23	±	0.31	0.793	54.2	1.82 ± 0.18	±	0.19
0.90–1.25						1.035	54.1	0.32 ± 0.04	±	0.06

	$60 < \theta < 75$					$75 < \theta < 90$				
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$			$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$		
0.13–0.16	0.146	66.9	22.16 ± 1.38	±	1.70	0.145	82.6	13.68 ± 1.04	±	1.16
0.16–0.20	0.179	67.2	21.81 ± 1.14	±	1.40	0.179	82.6	17.10 ± 0.99	±	1.15
0.20–0.24	0.219	67.3	19.71 ± 1.11	±	1.07	0.220	82.4	16.98 ± 1.00	±	0.98
0.24–0.30	0.267	66.8	16.52 ± 0.82	±	0.81	0.267	81.9	11.69 ± 0.68	±	0.61
0.30–0.36	0.330	66.7	15.43 ± 0.81	±	0.74	0.329	81.6	6.86 ± 0.50	±	0.38
0.36–0.42	0.388	66.8	9.72 ± 0.60	±	0.53	0.387	81.6	6.51 ± 0.49	±	0.39
0.42–0.50	0.453	67.1	7.58 ± 0.47	±	0.44	0.455	81.8	3.25 ± 0.30	±	0.22
0.50–0.60	0.542	66.7	4.63 ± 0.32	±	0.33	0.539	81.2	2.66 ± 0.24	±	0.23
0.60–0.72	0.651	66.5	1.96 ± 0.17	±	0.19	0.640	81.1	1.39 ± 0.16	±	0.15
0.72–0.90	0.791	65.8	1.08 ± 0.11	±	0.13	0.787	80.6	0.37 ± 0.06	±	0.05
0.90–1.25	1.014	65.3	0.17 ± 0.02	±	0.03	1.021	82.6	0.06 ± 0.02	±	0.02

	$90 < \theta < 105$					$105 < \theta < 125$				
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$			$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$		
0.13–0.16	0.145	97.2	16.36 ± 1.20	±	1.26	0.145	114.4	11.17 ± 0.79	±	0.95
0.16–0.20	0.179	97.3	12.10 ± 0.82	±	0.84	0.180	114.0	9.21 ± 0.59	±	0.71
0.20–0.24	0.220	96.8	11.00 ± 0.76	±	0.74	0.218	114.1	6.57 ± 0.51	±	0.45
0.24–0.30	0.266	97.2	8.49 ± 0.57	±	0.47	0.265	114.3	4.01 ± 0.33	±	0.27
0.30–0.36	0.327	97.1	5.03 ± 0.44	±	0.31	0.327	113.9	2.44 ± 0.26	±	0.19
0.36–0.42	0.388	96.1	3.78 ± 0.37	±	0.30	0.388	113.2	1.44 ± 0.20	±	0.14
0.42–0.50	0.456	96.3	2.19 ± 0.25	±	0.20	0.452	113.0	0.83 ± 0.13	±	0.10
0.50–0.60	0.545	96.6	1.31 ± 0.17	±	0.15	0.534	113.5	0.49 ± 0.10	±	0.07
0.60–0.72	0.645	96.2	0.36 ± 0.08	±	0.05	0.642	114.5	0.12 ± 0.04	±	0.02
0.72–0.90	0.784	97.1	0.13 ± 0.04	±	0.03					

Table A.45: Double-differential inclusive cross-section $\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$ [mb/(GeV/c sr)] of the production of π^-'s in π^- + C $\to \pi^-$ + X interactions with -15.0 GeV/c beam momentum; the first error is statistical, the second systematic; p_T in GeV/c, polar angle θ in degrees.

	$20 < \theta < 30$					$30 < \theta < 40$				
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$			$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$		
0.10–0.13	0.116	24.4	70.85 ± 3.47	±	5.43	0.115	34.4	45.26 ± 2.66	±	3.67
0.13–0.16	0.145	24.5	90.09 ± 3.63	±	5.88	0.144	34.6	59.75 ± 2.88	±	4.00
0.16–0.20	0.180	24.6	115.07 ± 3.45	±	6.68	0.178	34.6	66.72 ± 2.59	±	3.93
0.20–0.24	0.218	24.6	111.41 ± 3.35	±	5.87	0.219	34.6	67.19 ± 2.57	±	3.59
0.24–0.30	0.268	24.7	109.49 ± 2.72	±	5.26	0.267	34.5	67.70 ± 2.06	±	3.28
0.30–0.36	0.326	24.7	93.78 ± 2.49	±	4.26	0.326	34.6	54.41 ± 1.88	±	2.49
0.36–0.42	0.384	24.6	75.06 ± 2.20	±	3.44	0.385	34.7	48.35 ± 1.78	±	2.23
0.42–0.50	0.452	24.6	57.58 ± 1.69	±	2.86	0.451	34.7	37.10 ± 1.34	±	1.84
0.50–0.60	0.537	24.6	40.31 ± 1.26	±	2.36	0.541	34.6	25.08 ± 0.97	±	1.45
0.60–0.72	0.640	24.3	24.01 ± 0.87	±	1.77	0.643	34.7	14.86 ± 0.69	±	1.07
0.72–0.90						0.776	34.8	8.24 ± 0.42	±	0.78

	$40 < \theta < 50$					$50 < \theta < 60$				
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$			$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$		
0.10–0.13	0.116	44.9	31.85 ± 2.21	±	2.73					
0.13–0.16	0.145	44.7	44.36 ± 2.45	±	3.06	0.146	54.9	37.54 ± 2.23	±	2.77
0.16–0.20	0.180	44.6	50.36 ± 2.26	±	3.01	0.180	55.1	32.21 ± 1.77	±	1.95
0.20–0.24	0.219	44.6	43.62 ± 2.04	±	2.37	0.219	54.6	37.38 ± 1.95	±	2.04
0.24–0.30	0.269	44.6	43.57 ± 1.67	±	2.13	0.268	54.8	31.27 ± 1.40	±	1.54
0.30–0.36	0.328	44.7	35.01 ± 1.47	±	1.63	0.328	54.7	25.92 ± 1.28	±	1.23
0.36–0.42	0.388	44.6	30.55 ± 1.39	±	1.45	0.386	54.6	22.18 ± 1.18	±	1.09
0.42–0.50	0.458	44.9	23.28 ± 1.04	±	1.19	0.454	55.0	17.17 ± 0.88	±	0.91
0.50–0.60	0.543	44.7	16.78 ± 0.79	±	1.02	0.544	54.8	11.01 ± 0.65	±	0.69
0.60–0.72	0.646	44.8	10.18 ± 0.57	±	0.77	0.650	54.8	6.38 ± 0.44	±	0.50
0.72–0.90	0.790	44.4	4.19 ± 0.29	±	0.42	0.795	54.6	2.83 ± 0.24	±	0.29
0.90–1.25						1.000	54.3	0.47 ± 0.06	±	0.08

	$60 < \theta < 75$					$75 < \theta < 90$				
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$			$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$		
0.13–0.16	0.146	66.9	26.91 ± 1.51	±	2.03	0.145	82.7	17.62 ± 1.24	±	1.32
0.16–0.20	0.179	67.4	29.88 ± 1.37	±	1.79	0.179	82.5	19.45 ± 1.07	±	1.27
0.20–0.24	0.219	67.0	27.20 ± 1.31	±	1.43	0.220	82.2	18.12 ± 1.06	±	0.96
0.24–0.30	0.270	66.8	20.77 ± 0.93	±	1.00	0.269	82.1	13.97 ± 0.76	±	0.68
0.30–0.36	0.331	66.8	17.53 ± 0.84	±	0.84	0.331	82.1	9.76 ± 0.63	±	0.50
0.36–0.42	0.391	67.2	13.39 ± 0.75	±	0.68	0.390	81.7	7.59 ± 0.53	±	0.47
0.42–0.50	0.460	66.8	9.28 ± 0.52	±	0.54	0.460	81.6	5.57 ± 0.41	±	0.38
0.50–0.60	0.547	66.8	7.10 ± 0.41	±	0.49	0.547	81.6	3.56 ± 0.29	±	0.30
0.60–0.72	0.656	66.9	3.12 ± 0.25	±	0.27	0.659	81.9	1.70 ± 0.18	±	0.19
0.72–0.90	0.809	66.5	1.52 ± 0.14	±	0.18	0.796	81.5	0.67 ± 0.09	±	0.10
0.90–1.25	1.043	66.3	0.22 ± 0.03	±	0.04	1.039	81.5	0.09 ± 0.02	±	0.02

	$90 < \theta < 105$					$105 < \theta < 125$				
p_T	$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$			$\langle p_\mathrm{T}\rangle$	$\langle\theta\rangle$	$\mathrm{d}^2\sigma/\mathrm{d}p\mathrm{d}\Omega$		
0.13–0.16	0.146	96.8	17.19 ± 1.18	±	1.44	0.146	114.8	14.05 ± 0.89	±	1.18
0.16–0.20	0.180	97.4	18.13 ± 1.02	±	1.23	0.178	114.8	11.99 ± 0.71	±	0.81
0.20–0.24	0.220	96.9	15.38 ± 0.95	±	0.90	0.220	114.3	10.65 ± 0.70	±	0.60
0.24–0.30	0.267	96.7	10.30 ± 0.65	±	0.53	0.269	113.4	6.04 ± 0.43	±	0.37
0.30–0.36	0.329	96.7	6.90 ± 0.52	±	0.42	0.329	112.8	3.19 ± 0.31	±	0.25
0.36–0.42	0.394	97.1	4.48 ± 0.41	±	0.35	0.390	114.0	1.79 ± 0.22	±	0.18
0.42–0.50	0.457	96.5	2.94 ± 0.30	±	0.27	0.454	112.6	1.19 ± 0.16	±	0.15
0.50–0.60	0.548	96.4	1.47 ± 0.18	±	0.18	0.537	111.8	0.33 ± 0.08	±	0.05
0.60–0.72	0.642	95.9	0.58 ± 0.11	±	0.09	0.661	111.1	0.11 ± 0.04	±	0.03
0.72–0.90	0.768	94.2	0.14 ± 0.04	±	0.03					